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THE SERVICE OF MEDICINE TO CIVILIZATION[1]

Fellow Members of the American Medical Association: I wish to express my appreciation of the honor conferred on me in being called to officiate as your president at this time. I had been content to serve in the ranks, and I have regarded this position as too honorable to be sought, or to be lightly regarded when spontaneously bestowed. During my term of office I will give you my most devoted service.

In ancient times, civilization was born, grew for a few generations and fell into decay. In all instances it was local and covered only small areas. Its habitations were oases in the world-wide desert of ignorance and superstition, and after an ephemeral existence all were buried in the sand. Relatively small bodies of men occupying salubrious regions developed the elements of science and for a few centuries flourished. Their superior knowledge gave them dominion over their less fortunate neighbors, who were converted into slaves. Conquest brought disease and the local civilizations were obliterated by contagion. History is replete with instances in which triumphant heroes have brought to their rejoicing countries with their prisoners of war invisible and intangible agents of death, which have ultimately vanquished the victors.

The Egyptians of the Pharaohs drained the land, built aqueducts, disposed of their dead hygienically, reared temples and cities, maintained law and order, developed

[1] President's address before the American Medical Association, at the sixty-fifth annual session, Atlantic City, June, 1914.

the elements of literature and science and devised and employed simple machinery. In speaking of the ancient Egyptians, Diodorus says:

> The whole manner of life was so evenly ordered that it would appear as though it had been arranged by a learned physician, rather than by a lawgiver.

Herodotus declared ancient Egypt the healthiest of countries, but filled with physicians of whom

> one treats only the diseases of the eye, another those of the head, the teeth, the abdomen or the internal organs.

Writing of a later time, Gibbon said:

> Ethiopia and Egypt have been stigmatized in all ages as the original source and seminary of the plague.

It is evident that in the time of its great civilization Egypt was salubrious; coincident with the decline in the learning and wisdom of its people, it was visited and desolated by pestilence. That Egypt had lost its salubrity as early as the period of the exodus of the Israelites is shown by many passages in the Bible in which the chosen people are threatened with the diseases of Egypt if they neglect or violate the laws. Moses, "learned in all the wisdom of the Egyptians," codified his sanitary rules and regulations in the form of religious rites and ceremonies and thus secured their observance among the faithful even down to the present time.[2]

The Greek developed the most glorious civilization of antiquity because he was the most ardent student of science, but he was unable to cope with malaria and bubonic plague, and his descendants have been in bondage to malaria for nearly twenty-four centuries. The medicine of Hippocrates, the wisdom of Socrates, the philosophy of Plato, the plays of Aristophanes, the laws of Pericles and the science of Aristotle could not save the Greek from the degrading effects of disease, and under its withering influence the civilization of this great people slowly but surely decayed. Its matchless marbles were thrown into the waste, its magnificent temples were allowed to crumble, its altars were deserted, its literature became insipid, its philosophy lost its virility, its science was forgotten and the children of this blighted civilization were sold in the slave markets of Rome and in later generations paid tribute to the Slav and the Turk. There certainly were eminent Greek scientists and physicians for centuries after Hippocrates, but they were not products of Greek soil. They developed in Asia Minor, Egypt, Italy and elsewhere. It is of interest to note in this connection that malaria, according to Jones, was introduced into Greece in the fifth century, B.C., and the fourth century showed the decline of Hippocratic medicine. Neuburger says:

> The sons and grandsons of Hippocrates, as well as his immediate disciples, Apollonios and Dexippos, were at the head of that series of physicians who laid emphasis upon theoretical conjecture and gave to medicine in the fourth century B.C. its speculative coloring.

Taken with the fact that other departments of learning showed similar retrogression at the same time, this sequence between the introduction of malaria and the trend of medicine toward speculation is worthy of record. That pestilence aided the barbarians in the final desolation of Greece is indicated by the following quotation from Thumb:

[2] Neither the papyrus of Ebers nor that of Brugsch throws any light on the problems discussed in this article. Indeed the value of both these papyri was at first overestimated. They are now regarded as compilations and consist largely of lists of remedies and furnish no information concerning epidemics or their effects upon the people, except to indicate that hookworm or bilharzia infection, one or both, at that time (about 1500 B.C.) afflicted the Egyptians. These parasites may have contributed to the deterioration of the people; this is a suggestive possibility.

At a time when the German tribes began moving, that is to say, at the end of the third century A.D., a gradual immigration of Slavonic tribes into the Balkans began; their invasions became more and more frequent, since the Goths chose Western Europe as the goal of their conquering expeditions and left to the Slavs an open passage into the Balkan countries. But a real Slavonization of some Greek territories took place only in the eighth century, and attained its highest point when a horrible plague in 746 depopulated the Greek territories.

I am aware of the fact that some have objected to considering the present inhabitants of Greece as descendants of ancient Greeks. The former have been designated as "so-called Greeks," "a bastard people," "a mosaic of Vlacks, Arnauts and Slavs." Some years ago Fallmerayer made the very positive statement that "no drop of ancient Greek blood flows in the veins of the modern Greek." Thumb has shown the absurdity of these statements and declares that cranial measurements, local names, customs and religion show that while some admixture with the Slav has taken place, the modern Greek is a lineal, and on the whole a fairly pure descendant of those who established the greatest civilization of antiquity. Modern Greek Christianity is only a modification of ancient Greek paganism, in which gods have been supplanted by saints.

Charon the old ferry-man in the underworld is to-day the god of death; he conducts the souls in a dreary procession to his realm. As in antiquity, a copper coin is put into the mouth of a dead person as a fee for the ferry into the other world. The ancient Moirai or fates (to-day, Mires) still determine the fate of the new-born child, spin and cut the thread of life. The bride is conducted into her new home, the dead are buried with ceremonies which the Greeks used already two thousand years ago. A sick person seeks recovery by laying down to sleep in the church of a saint, like those persons who once made a pilgrimage to the temple of Asklepios in Epidaurus. The Greeks of to-day are descendants of the ancient Hellenes, not in the sense in which every modern Greek could trace his origin back to an ancient Athenian or Spartan, but in the sense that in the modern people ancient blood flows largely and in some districts almost purely, and still more in the higher sense that the modern race shows a development of the Greek population of the ancient world.

The broken remnants of older civilizations found refuge and asylum in the salubrious climate of the Italian peninsula and soon its hillsides were covered with vines and olives while its plains and valleys bore abundant harvests. Rome was built and her empire promised to extend to the remotest parts of the world, but the ancient Roman contributed but little to science, and we are told by the historian that

a pestilence raged for fifteen years (251–265) and carried off one half of the inhabitants of the empire.

The seat of civilization was moved to the shore of the Bosphorus, but the lamp of science was well-nigh extinguished and the clouds of the middle ages enveloped the world and shrouded its inhabitants for more than a thousand years.

A fabulous and formless darkness overcame the fairest things of earth.

If one reads the history of the decline of the Roman Empire, he can hardly fail to see that disease was an important factor in that retrograde movement, which involved the greater part of the then known world. Jones and Ross find the earliest reference to malaria among the Romans in the comedian Plautus, who died 184 B.C., and they quote Terence, who died 159 B.C., and whose language is explicit in showing not only the prevalence of malaria, but also the recognition of the different forms. From that time on, reference to the wide prevalence of malarial diseases, not only in the open country, but also in the city, is frequent and definite. Jones says:

There is then, every reason for supposing that malaria was unknown in Italy in early times, was well known at the beginning of the second century

B.C., and that it gradually became more common during the next two hundred years. If this be so, it is at least a plausible conjecture that it was introduced by Hannibal's Carthaginian mercenaries. Africa seems to have been the original home of the disease, and it is probable that some of his troops were infected. The constantly repeated devastation of Italy in the second Punic war should be sure to turn a large part of it into marshy land, thus affording a convenient breeding-place to the mosquitoes which were infected by the malarial patients among the Carthaginians. The similar condition of Attica during the closing years of the fifth century B.C. offers a striking parallel. This opinion does not rest on mere conjecture. We are told by Livy that in the year 208 B.C. a severe epidemic attacked Italy. It did not cause many deaths, but resulted in much lingering disease, that is, most probably, chronic malaria.

Malaria, however, was not the only disease which contributed to the degeneration of the Roman people. I have already referred to the pestilence of the third century, which is said to have destroyed half the inhabitants of the vast empire within fifteen years. This certainly was not malaria. Moreover, this was not the first great pestilence which afflicted the Roman Empire. Neuburger says:

The "plague," so called by Galen or Antonine, was first introduced from Syria by the Roman army. . . . The extraordinary contagiousness of the epidemic is emphasized in all contemporary reports. There appear to have been a variety of simultaneous manifestations, the descriptions indicating afflictions chiefly resembling small-pox or dysentery, but adequate criteria on which to express an opinion are wanting. The "plague" commenced 165 A.D., claimed innumerable victims and lasted at least fifteen years.

Jerome writes: With peace, order and good government a curious lethargy fell on the warrior state deepening into a coma in which it died so quietly that neither the contemporaries nor we moderns can fix the date of the disease. The fact, however, finally became apparent when the phenomena of decay were indubitable and the world, deprived of the master, fell back helplessly into a condition hardly more advanced than in the ages before its subjection, save that it had the imperishable memory of Rome to give it hope, direction and courage.

In the fourth century the seat of government was removed to Byzantium. It is probable that this change was, in part at least, determined by the insalubrity of Italy. Early in the fifth century Rome was pillaged, but the real conquerors of Rome were not the Goth and Vandals, but malaria and the plague. Disease continued to devastate Italy. Creighton says:

About the year 668 the English archbishop-elect, Vighard, having come to Rome to get his election confirmed by the pope, Vitalanius, was soon after his arrival cut off by the pestilence with almost all who had gone with him. Twelve years after, in 680, there was another severe pestilence in the months of July, August and September, causing a great mortality at Rome and such a panic at Pavia that the inhabitants fled to the mountains. In 746 a pestilence is said to have advanced from Sicily and Calabria and to have made such devastation in Rome that there were houses without a single inhabitant left.

From that time on the plague periodically spread over Italy until the seventeenth century, while malaria has been in continuous possession down to our own time. We are told that the epidemic of 1348 reduced the inhabitants of the Eternal City to 20,000.

We are familiar with the graphic description of the plague in Florence by Boccaccio, who wrote:

Such was the cruelty of Heaven, and perhaps of men, that between March and July following, it is supposed, and made pretty certain, that upwards of a hundred thousand souls perished in the city only, whereas, before that calamity, it was not supposed to have contained so many inhabitants. What magnificent dwellings, what noble palaces were then depopulated to the last person, what families extinct, what riches and vast possessions left, and no known heir to inherit, what numbers of both sexes in the prime and vigor of youth—whom in the morning neither Galen, Hippocrates nor Esculapius himself, but would have declared in perfect health—after dining heartily with their friends here, have supped with their departed friends in the other world.

There are but few passages in literature so tragic as the short record of the plague

of the fourteenth century begun by the friar of Kilkenny, but soon interupted by his death:

I friar, John Clyn, of the order of Friars Minor and of the convent of Kilkenny, wrote in this book those notable things which happened in my times, which I saw with my eyes, or which I learned from persons worthy of credit. And lest these things worthy of remembrance should perish with time and fall away from the memory of those who are to come after us, I, seeing these many evils, and the whole world lying, as it were in the wicked one, *among the dead, awaiting death*—as I have truly heard and examined, so have I reduced these things to writing; and lest the writing should perish with the writer, and the work fail altogether with the workman, I leave parchment for continuing the work, if haply, any man survive, and any of the race of Adam escape this pestilence and continue the work I have commenced.

That the period of the Byzantine Empire (395–1453) was one of general degeneracy is shown on every page of the historian. It produced no literature of merit, and "the study of nature was regarded as the surest symptom of an unbelieving mind." Neuburger says:

The Byzantines merely followed the downward path. Surfeited with tradition, which made modes of thought appear inevitable, because customary, filled as a nation with overweening self-conceit, fed by the glories of the Græco-Roman past, they neither could nor would destroy the historic bridge nor replace the crumbling ruin with a new edifice. It lay outside the sphere of their interests to enter into that conscious emulation of antiquity which, emphasizing the growing contrast between past and present, and eliminating the obsolete and the inert, is the essence of mental cultivation. Forgetting that it was the free development of the national spirit which constituted the greatness of the past, they went so far as to smother its liveliest expression by denying, in their rigid adherence to Attic speech, all part in literature to the language of the people. The more incapable did the Byzantines become of grasping the spirit, the more tenaciously did they cling to the letter—a reflection of the mania for titles and ceremonies in political life—and thus they dragged the inanimate mechanism, the dry bones of antiquity through a thousand years, instead of erecting a new edifice on the foundations of antiquity.

The physician and historian, Procopius, in his account of the great pestilence in the reign of Justinian "emulated the skill and diligence of Thucydides in the description of the plague at Athens." Of this epidemic Gibbon says:

In time its first malignancy was abated and dispersed; the disease alternately languished and revived; but it was not till the end of a calamitous period of fifty-two years, that mankind recovered their health, and the air resumed its pure and salubrious quality. No facts have been preserved to sustain an account, or even a conjecture, of the numbers that perished in this extraordinary mortality. I only find that during three months, four and at length ten thousand persons died each day at Constantinople, that many cities of the east were left vacant, and that in several districts of Italy, the harvest and the vintage withered on the ground. The triple scourge of war, pestilence and famine afflicted the subjects of Justinian, and his reign is disgraced by a visible decrease of the human species, which has never been replaced in some of the fairest countries of the globe.

This epidemic spread over the whole of Europe and it took more than a century to reach England, where "it fabled long after in prose and verse as the great plague of Cadwallader's time." Then for quite a thousand years it reaped its periodic harvests as often as immunity was lost in new generations.

The historian, as a rule, confines his descriptions to martial and political events and consequently gives a wholly erroneous idea of true conditions. Gibbon says:

If a man were called upon to fix the period in the history of the world, during which the condition of the human race was most happy and prosperous, he would without hesitation, name that which elapsed from the death of Domitian to the accession of Commodus (from 96 to 180 A.D.).

Noah Webster, in his work on epidemics and pestilence, quotes the preceding with the following just comment:

It is certain that, at this time, the Roman Empire was in its glory, and governed by a series of able and virtuous princes, who made the happiness

of their subjects their principal object. But the coloring given to the happiness of this period is far too brilliant. The success of armies and the extent of empire do not constitute exclusively the happiness of nations; and no historian has a title to the character of fidelity, who does not comprehend, in his general description of the state of mankind, moral and physical, as well as political evils.

Let us make brief inquiry into the diseases of this "most happy and prosperous" period. It was preceded by, it began in, continued in, and closed in pestilence. That the plague was endemic in Italy at that time and that it developed in epidemic form with each increase in susceptible material there can be no doubt. Of the epidemic of 68 A.D. Tacitus says:

Houses were filled with dead bodies and the streets with funerals; neither age nor sex was exempt; slaves and plebeians were suddenly taken off, amidst the lamentations of their wives and children, who, while they assisted the sick, or mourned the dead, were seized with the disease, and perishing, were burned on the same funeral pyre. To the knights and senators the disease was less mortal, though these also suffered in the common calamity.

About this time the plague appears to have spread over the whole of Asia, northern Africa and Europe. According to Short, the deaths from this disease in Scotland between 88 and 92 A.D. amounted to not less than 150,000. This was probably not less than one fourth, possibly one half, the population of Scotland at that time.

In the year 80 A.D. the deaths from the plague in Rome at the height of the epidemic numbered 10,000 a day. It is estimated that the population of Rome at that time was somewhat more than one million. Exacerbations of the disease in Rome are recorded for the years 102, 107 and 117 A.D. According to Short, 45,000 died of the plague in Wales in 114. The year 167 A.D. is noted for an unusually severe outbreak of the plague at Rome, where it continued for many years. In the year 173 A.D., the Roman army was threatened with extinction by disease, and special epidemics, or rather exacerbations of the epidemic, prevailed in Rome in 175 and 178 A.D. That the "happy and prosperous" period was followed by a continuation of the plague is shown by the following quotation from Herodian:

A great pestilence raged throughout Italy at that time (about 187 A.D.), but with most violence in the city, by reason of the great concourse of people assembled from all parts of the earth. The mortality among men and cattle was great. The Emperor, by advice of physicians, retired to Laurentium, on account of the coolness of the place, which was shaded with laurels. It was supposed that the fragrance of the laurels acted as an antidote against the contagion. The people in the city also, by the advice of physicians, filled their noses and ears with sweet ointments and used perfumes, etc.

Under the spell of the historian we have been inclined to regard the period when the greater philosopher, Marcus Aurelius Antoninus, sat on the throne of the world, as the golden age. Let us therefore listen to a few words from his personal attendant, courtier and historian, who writes:

Unless he, M. Antoninus, had been born at this juncture, the affairs of the empire would have fallen into speedy ruin; for there was no respite from military operations. War raged in the east, in Illyricum, in Italy and in Gaul. Earthquakes with the destruction of cities, inundations of rivers, frequent plagues, a species of locusts ravaging the fields; in short every calamity that can be conceived to afflict and torment man scourged the human race during his administration.

It is estimated that during the dark ages the average of human life was less than twenty years. A high birth-rate was necessary to keep the race alive, but notwithstanding this, Europe was sparsely inhabited. At the time of the Norman Conquest the inhabitants of England numbered between two and two and one half million, probably nearer the former, for they had

not reached the greater number a hundred years later. Creighton says:

> It would be within the mark to say that less than one tenth of the population was urban in any distinctive sense of the term. After London, Norwich, York and Lincoln, there were probably no towns with five thousand inhabitants.

Indeed, urban life, as we now know it, was quite impossible in this age of pestilence and would soon become so again were the functions of preventive medicine relaxed.

Most of the great epidemics of the middle ages were designated as *pestilentia* or *magna mortalitas*. In the most deadly visitations the bubonic plague is so accurately described that there can be no doubt about its identity, but it must not be supposed that the people enjoyed any high degree of health even in those periods when this contagion languished on account of exhaustion of susceptible victims. Ergotism, under the name of Saint Anthony's fire, was endemic in France and adjacent territories; Normandy was filled with lepers, but Christ's poor were not confined to that country. England was regarded as the special home of hunger, but abundance was a stranger to the masses in every land. The mysterious sweating sickness, apparently brought to England with Henry Tudor in 1485, developed in five distinct epidemics which were characterized by the fact that the mortality was greater among the rich than among the poor. Typhus, known as *morbus pauperum*, prevailed largely in the jails, on ships and among the squalid inhabitants of the cities. Even the discovery of America carried to Europe the scourge of syphilis, which was spread over Italy by the soldiers of Charles VIII., and within a few years reached the most distant parts of Europe. Smallpox appeared in England in the sixteenth century, having journeyed, according to the most reliable authority, all the way from the Orient. That tuberculosis, diphtheria, dysentery and other diseases, still with us, prevailed during the middle ages is shown by the records, but they were overshadowed by the higher mortality of those mentioned above. Improved agriculture has extinguished the fire of St. Anthony, except in the most benighted provinces of Russia. The great fire in London in 1666 destroyed the infected rats and relieved England of the bubonic plague, which had been endemic in that country since 1349. Something more than one hundred years later the discovery of Jenner robbed smallpox of its horrors, wherever vaccination is properly enforced. The investigations of Howard improved the sanitation of jails and workhouses, and did much to eradicate typhus.

The claim has been advanced that the infectious diseases have benefited the race by the destruction of the unfit. This idea I have combated most vigorously since our study of typhoid fever in the army in 1898. My colleagues and I found that out of 9,481 soldiers who had previously been on the sick report and could not be regarded as possessing standard health, 648, or 6.8 per cent., contracted typhoid fever; whereas, out of 46,384 men who had no preceding illness, 7,197, or 15.3 per cent., developed typhoid fever. More than 90 per cent. of the men who developed typhoid had no preceding intestinal disorder. Under ordinary conditions the strong, busy man, especially the one whose activities demand wide excursions from his home, is more likely to become infected than the one whose sphere of action is more limited on account of infirmity. The reason for this is too obvious to need statement, and it follows that more men than women and more adults than children have typhoid fever. Moreover, the case mortality is greater among the strong, because death in the infectious dis-

eases is often due to the rapidity with which the invading organism is broken up by the secretions of the body cells and the protein poison made effective. From this I have concluded that contagion, like war, destroys the very flower of the race. This view is sustained by the historians of the pestilences of former times.

Thucydides in his description of the plague at Athens says:

> Moreover, no constitution, whether in respect of strength or weakness, was found able to cope with it; nay, it swept away all alike, even those attended to with the most careful management.

Procopius in his account of the Justinian epidemic states that youth was the most perilous season, and females were less susceptible than males.

Cogan, in describing the outbreak of typhus at Oxford in 1577, writes:

> The same kind of ague raged in a manner over all England, and took away very many of the strongest sort, and in their lustiest age, and for the most part, men and not women and children, culling them out here and here, even as you would choose the best sheep out of a flock.

In his account of the plague of 1665 in London, Boghurst makes the following statement:

> Of all the common hackney prostitutes of Luteners-lane, dog-yard, cross-lane, Baldwins-gardens, Hatton-gardens and other places, the common criers of oranges, oysters, fruits, etc., all the impudent drunken, drubbing bayles and fellows and many others of the *rouge route*, there is but few missing—verifying the testimony of Diemerbroech that the plague left the rotten bodies and took the sound.

Like testimony comes from an account of the plague at Moscow:

> Drunkards and persons of feeble temperament were less subject to attack.

Davidson observed that typhus fever was more frequent among the robust than the weak. He states that out of 429 cases the spare and unhealthy taken together made only about 17 per cent. He adds that the death-rate among the poor was one in twenty-three, while among the well-to-do it was one in four. The greater mortality of typhus among the higher classes has been noted by Barber and Cheyne and by Braken.

Hurty, nearly a century ago, wrote:

> A fever which consigns thousands to the grave, consigns tens of thousands to a worse fate—to hopeless poverty, for fever spares the children and cuts off the parents, leaving the wretched offspring to fill the future ranks of prostitution, mendicancy and crime.

Creighton says:

> The best illustrations of the greater severity and fatality of typhus among the well-to-do come from Ireland in times of famine, and will be found in another chapter. But it may be said here, so that this point in the natural history of typhus may not be suspected of exaggeration, that the enormously greater fatality of typhus (of course, in a smaller number of cases) among the richer classes of the Irish families, who had exposed themselves in the work of administration, of justice, or of charity, rests on the unimpeachable authority of such men as Graves, and on the concurrent evidence of many.

A surgeon in the British navy at the time of William III and Anne tells how he was led to practise bleeding in fever as follows:

> I had observed on a ship of war, whose complement was near 500, in a Mediterranean voyage in the year 1694, when we lost about 90 or 100 men, mostly by fever, that those who died were commonly the young, but almost always the strongest, lustiest, handsomest persons, and that two or three escaped by such natural hemorrhages, which were five or six pounds of blood.

The middle ages were indeed dark physically, intellectually and morally. Here and there, now and then, some man of genius towered above the general low level of his contemporaries and not infrequently he paid dearly for his audacity. For some centuries the Arab, especially in Spain, stood out alone as the torch-bearer of science, and he, when driven back into the

insalubrity of Northern Africa, lapsed into barbarism. Neuburger writes:

> Fortunately the fate of medieval medicine was not dependent on Byzantium alone. An admirable illustration of the doctrine of conservation of energy is afforded by the fact that, with the decline of intellectual energy at home, a contemporaneous development of Greek medicine took place abroad, which, if at times misguided, was yet full of vitality, whilst the medical art of the newly arisen world of Islam reached a height unsurpassed during the middle ages.

In the greater part of Europe, ignorance and disease held full sway. In the midst of great calamities "the will-o-the-wisp of superstition is an irresistible attraction and offers the only ray of hope." Strong men, neglectful of their earthly duties, betook themselves to secluded places and lost themselves in dreams of a heavenly paradise. Mysticism, fanaticism and superstition dominated all conditions of men. Rulers, illiterate, immoral and even incestuous, occupied palaces while the masses died of starvation. The history of the time is a record of diseased, degenerated, demented man. There can be no doubt that disease has overthrown civilizations in the past, and there is no surety that it may not do so again. The recent outbreak of the plague in Manchuria and its more recent appearance in Cuba are not without their warnings. It remains to be seen if those who control our government have the intelligence necessary to protect our country against the invasion of pestilence. The failure to provide for camp sanitation in 1898, the behavior of California officials on the finding of plague in San Francisco and the general indifference of national and state authorities toward the eradication of disease discourage the hope that intelligent patriotism is widely distributed among us. As a contemporary of Mr. Dowie and Mrs. Eddy and as a citizen of a country in which the osteopath and chiropractic flourish, I feel some embarrassment in speaking of the fanaticism and ignorance of the dark ages.

The history of medicine is that of mankind. Born in naked ignorance, bound in the swaddling-clothes of credulity and nursed on superstition, medicine has had its savants and its fakers, its triumphs and its failures, its honors and its disgraces. It has attracted and still attracts to its ranks men of the purest motives and those who are impelled by the basest desires. It can be said without fear of contradiction that medicine has done more for the growth of science than any other profession, and its best representatives in all ages have been among the leaders in the advancement of knowledge, but the average medical man conforms in intellect and character to the community in which he lives. The food of the faker is ignorance and he thrives where this commodity is most abundant. The uncontrolled fool moves to his own destruction. This is the only way in which nature can eliminate him. A wise government protects its incompetents from medical and other fakers, but such government can exist only where wisdom predominates.

A study of epidemics shows that in the presence of widespread contagion mankind in the mass tends to revert to the barbaric state. This is the unvarying testimony of all authorities, medical and lay, secular and religious, who have made the records. The historian Niebuhr, in discussing the report on the plague in Athens by Thucydides says:

> Almost all great epochs of moral degradation are connected with great epidemics.

F. A. Gasquet, abbot president of the English Benedictines, in his history of the black death, writes:

> The immediate effect on the people was a religious paralysis. Instead of turning men to God, the scourge turned them to despair, and this not

only in England, but in all parts of Europe. Writers of every nation describe the same dissoluteness of manners consequent upon the epidemic.

A Venetian historian notes the general dissoluteness which followed the disease and its effects in lowering the standard of probity and morals. Covino of Montpellier bears testimony to the baneful effects of the scourge on the morals of those who escaped, and concludes that such visitations exercise the most harmful influence on the general virtue of the world. William of Nangis, in his history of the plague in France in 1348, concludes with the following:

> But alas! the world by this renovation is not changed for the better. For people were afterwards more avaricious and grasping, even when they possessed more of this world's goods than before. They were more covetous, vexing themselves by contradictions, quarrels, strifes and lawsuits.

Many similar references could be given, but these suffice to show that disease breeds ignorance, immorality and strife. Our inquiries into the influence of disease on civilization, however, have brought out the fact that people living in comparative health have within a few generations made beginnings, at least, some, highly creditable, in government, literature and science. The Hellenic tribes of Greece built up their wondrous civilization within a few centuries. It is true that Rome was not built in a day, but the seven hills were covered with houses and temples, the great aqueducts brought abundant supplies of pure water from the mountains and the wonderful sewers remain as evidence of sanitary skill, and all this was accomplished in a relatively short period measured in the history of the race. The world moved forward at a rapid pace with the dawn of science in the last century. It is not extravagant to prophesy that with ten centuries of freedom from disease, both inherited and acquired, the world would be regenerated and the superman be born.

It is not necessary to turn to history for examples of the degrading effects of disease on man. We see it to-day in the physical inferiority, intellectual weakness and moral irresponsibility of those peoples who are still under the domination of malaria and kindred diseases. My illustrious predecessor in this office, Dr. Gorgas, has demonstrated what scientific medicine may accomplish in these pestilential regions, and it is within reason to look forward to the time when the tropics may supply choice locations for civilized man. In like manner the valleys of the Tigris and Euphrates are being reclaimed and Babylon and Nineveh may again become seats of learning and culture. The modern sanitarian is quite competent to rebuild the home in which the cradle of civilization was rocked.

After the last epidemic of the plague in London in 1665 the death-rate, so far as it can be ascertained, fell to between 70 and 80 per 1,000. During the next century it fell as low as 50, but fluctuated greatly with recurring epidemics of typhus and smallpox. In the nineteenth, it gradually and quite constantly decreased and is now about 14. In 1879–80, the first year in which the mortality statistics of the United States possess sufficient accuracy to be of any value, the death-rate in the registered area was 19.8; in 1912 it was 13.9—a decrease of 30 per cent. During the same time the mortality from typhoid fever has decreased 50 per cent.; that from scarlet fever 89 per cent.; that from diphtheria 84 per cent.; that from tuberculosis 54 per cent. Hoffman states that had the death-rate for tuberculosis in 1901 continued there would have been 200,000 more deaths from this cause from that date to 1911 than actually did occur, or the actual saving of lives from

death by tuberculosis accomplished in that decennium averaged 20,000 per year. A battle in which 20,000 are slain stirs the world at the time and fills pages of history later. Preventive medicine measures its successes by the number of lives saved, and 20,000 a year preserved from death from one disease is no small triumph. In the last century the average of human life has been increased fifteen years and this increase could be duplicated in the next twenty years if the facts we now possess were effectively employed.

Hoffman further states that the addition to the material wealth of this country secured by the reduction of deaths from tuberculosis within ten years amounts approximately to 6,200,000 years of human life, covering its most productive period. Medicine discovered the facts which have made this great work possible and has directed their application. With evidence of this kind before them, will our lawmakers listen to those who demand recognition as practitioners of medicine without proper qualification?

The further developments of medicine, both curative and preventive, depend on scientific investigations. The public is the beneficiary and should in every way encourage medical research. By the application of discoveries already made, the burden of disease has been lightened, sickness has become less frequent and less prolonged, a greater degree of health has been secured, the efficiency of the individual and of the nation has been increased and life has been prolonged and made more enjoyable. The federal government and the states should sustain and promote scientific research. That government is the best which secures for its citizens the greatest freedom from disease, the highest degree of health and the longest life, and that people which most fully secures the enjoyment of these blessings will dominate the world.

Medicine consists of the application of scientific discovery to the prevention and cure of disease. All else which may go under the name of medicine is sham and fraud. Without advancement in the physical, chemical and biologic sciences there can be no progressive movement in medicine. Scientific knowledge is gained only by observation and experiment. Before the time of Jenner, we are told by the historian, it was unusual to meet in London one whose face was not marked by smallpox. There was a popular belief that one who had cowpox was immune to smallpox. Jenner put this belief to a scientific test and the result was the discovery of vaccination, and this secured the abolition of this disfigurement and a marked reduction in mortality.

In 1849, a village doctor, with a crude microscope, studied the blood of animals sick with anthrax and compared it with that of healthy ones. He discovered the anthrax bacillus. This work was extended by Davaine, Pasteur, Koch and others, and from this the science of bacteriology has been developed. The particulate causes of many infectious diseases have been recognized, isolated and their effects on animals demonstrated. Many of the mysteries of contagion have been revealed and the conditions of the transmission of disease made known. The fundamental principles of preventive medicine have been developed into a science which is to-day the most potent factor in the progress of civilization.

Finlay suspected a certain mosquito to be the carrier of the virus of yellow fever. Reed and his co-workers demonstrated the truth of this theory and the work of Gorgas has freed Havana from the pestilence and the construction of the Panama Canal is an accomplished fact.

We are sorry for the Greek, whose bodily health, mental strength and moral sense were depressed by the invisible and insidious organisms of malaria, and truly his memory deserves our sympathy. He had no microscope, and how could he detect or even suspect that the mosquitoes which had annoyed his ancestors for generations had armed their lancets with deadly poison brought from Africa? The Greek had never heard of quinin and the other cinchona alkaloids. He did not know the land whose forests were even then elaborating those products, which, centuries later, were of greater value than gold to man, and proved to be an essential help in the uplift of mankind. Laveran discovered the *Plasmodium malariæ*. Ross studied its life history and the fetters of this disease, which has so long retarded the progress of man, have been broken. Mitchell and Reichart investigated the poisonous properties of snake venom. Sewall immunized animals with it. Ehrlich studied the similar bodies, abrin, ricin and diphtheria toxin, and von Behring and Roux gave the world antitoxin, the magical curative value of which has greatly reduced the mortality from this disease. The experiments of Villemin demonstrated the contagious nature of tuberculosis, long suspected and frequently denied. The diligent research of Koch resulted in the recognition and isolation of the causative agent, and since this discovery the mortality of the Great White Plague in Europe and the United States has been diminished more than half, and it is within the range of sanity to look forward to the time, when the former "Captain of the hosts of death" will be known only by the fearful records he once made in the history of man's struggle to be relieved from the heavy tribute paid to infection.

We boast of a great civilization, but this is justified only within limits. Science more nearly dominates the world than at any time in the past. Learning permeates the masses more deeply, but credulity and ignorance are widely prevalent. In this country of nearly one hundred millions, there are thousands whose greed impedes the progress of the whole, tens of thousands whose ignorance retards their own growth, and other thousands who live by crime and procreate their kind to feed on generations to come. We have our schools, colleges and universities, while our almshouses, insane asylums and penal institutions are full. In our cities we see the palatial homes of the ultra rich, the splendid temples of trade and commerce, the slums of want and poverty and the homes, both rich and squalid, of vice and crime. No nation in this condition can be given a clean bill of health. Our hill-tops are illuminated by the light of knowledge, but our valleys are covered by the clouds of ignorance. We have not emerged from the shadows of the dark ages. The historian of the future will have no difficulty in convincing his readers that those who lived at the beginning of the twentieth century were but slightly removed from barbarism, as he will tell that the school, saloon and house of prostitution flourished in close proximity; that the capitalist worked his employees under conditions which precluded soundness of body; that the labor union man dynamited buildings; that whilst we sent missionaries to convert the Moslem and the Buddhist ten thousand murders were committed annually in our midst, and that a large percentage of our mortality was due to preventable disease.

Evidently there is much to be done before we pass out from the shadows of ignorance into the full light of knowledge. In this great work for the betterment of the race the medical profession has important duties to perform. I do not mean to

imply that the uplift of mankind devolves wholly on the medical man. The burdens are too many and too diversified, the ascent too steep and the pathways too rough for one profession to hope to reach unaided the high plateau we seek. Moreover, other callings have no right, and should have no desire, to shirk the moral responsibilities, which rest alike on all. But in past ages, medical men have been the chief torch-bearers of science, the only light in which man can safely walk, and we must keep and transmit to our successors this trust and honor. I know of no scientific discovery, from the ignition of wood by friction to the demonstration of the causes of infection and the restriction of disease, which has not sooner or later assisted in the betterment of the race. It may be added that nothing else has so aided man in his slow and halting progress from the pestilential marshes of ignorance to the open uplands of intelligence.

In so great a work as the eradication of preventable disease, all intelligent people must cooperate. The law must support by proper enactments, and these must be enforced with justice and intelligence; it must recognize that the right to enjoy health is quite as sacred as that to possess property; that to poison men in factories and mines, to pollute drinking-water supplies, to adulterate foods and to drug with nostrums is manslaughter. Religion must teach the sanctity of the body as well as that of the soul, that ignorance is sin and knowledge virtue, that parenthood is the holiest function performed by man and that to transmit disease is an unpardonable sin. The teacher must know hygiene as well as mathematics. The capitalist must recognize that improvement in health and growth in intelligence increase the efficiency of labor. There never has been a time when scientific medicine has had so many and such efficient and appreciative helpers as it has to-day. Our sanitary laws are for the most part good, but their administration is weak, on account of ignorance. The pulpits of the land are open, for the most part, to the sanitarian. The respectable newspapers are most effective in the crusade against quackery and disease. The philanthropist has learned that the advancement of science confers the greatest and most lasting benefits on man.

There is a moral obligation to be intelligent. Ignorance is a vice and when it results in injury to any one it becomes a crime, a moral, if not a statutory one. To infect another with disease, either directly or indirectly, as a result of ignorance, is an immoral act. The purpose of government is to protect its citizens, and a government which fails to shelter its citizens against infection is neither intelligent nor moral. To transmit disease of body or mind to offspring is an unpardonable sin. In a reasonable sense it is worse than murder, because it projects suffering into the future indefinitely.

That medicine has become a fundamental social service must be evident. To return one incapacitated by illness or injury to the condition of self-support benefits not only the individual, but the community, inasmuch as it increases its productive capacity. Infirmity is a direct burden on the individual and scarcely less direct on the community. Weakness in any part diminishes the strength of the whole. It is a fully established principle in social economy that wide-spread intelligence and growth in knowledge are beneficial to the state.

It was in full recognition of this that the framers of the Ordinance of 1787 wrote into that immortal document:

> Religion, morality and knowledge being necessary to good government and the happiness of

mankind, schools and the means of education shall forever be encouraged.

The Territory of the Northwest, the government of which was provided in this ordinance, was at that time a vast waste of forest and prairie, furnishing a scant and precarious subsistence for savage tribes and attracting to its borders a few of the most hardy sons of civilization. The knowledge for whose growth and diffusion the wise provision was made, has drained the malarial marshes, converted wild prairie and tangled wood into fruitful orchards and fertile fields, dotted the whole area with neat villages, reared great cities, linked all parts with steam and electric roads, and provided comfortable homes and abundant food for millions. The men who wrote the Ordinance of 1787 left a great inheritance which is temporarily in our possession. Let us write into this great document:

Every ill which can be relieved shall be removed, and every preventable disease shall be prevented.

The wisdom of our fathers has secured for us a greater measure of health and a longer term of life; let us do as well for those who are to possess this fair land in the next generation. Let us live not only for ourselves and the present, but for the greater and more intelligent life of the future.

Not myself, but the truth that in life I have spoken
Not myself, but the seed that in life I have sown
Shall pass into ages—all about me forgotten,
Save the truth I have spoken, the things I have done.

All things are relative and health is no exception. With a greater degree of health among all, religion will become more effective for good, morality will have a deeper significance and a wider application and knowledge will multiply and distribute its blessings more widely.

In the further improvement of the physical, mental and moral conditions of the race, medicine should continue to be a leader. There is no other calling so essential to this movement, and in order to more thoroughly fit itself for this important task the profession should first of all look to its own betterment. The medical man should possess intelligence of high order, manifest industry without stint and show the highest integrity in all he does. That it is the aim of this association to attract to its colors men possessing these qualifications and to deny admission to others is shown by the advance in the standard of medical education, the enforcement of medical registration laws and the denunciation of every form of medical charlatanism. In all these directions the profession has the support of the more intelligent men in other callings. The improvement in medical training secured within recent years in this country is without a parallel in the history of education. The requirements for admission to the medical schools have been rapidly advanced and standardized; the number of medical schools has been reduced from 166 to 104 by obliteration and combination, much to the improvement of all, and a far better class of matriculates has been secured. The courses of instruction have been lengthened and made more scientific. Each good medical school is doing more or less of research which is not confined to laboratory investigators, but is fast finding its way into hospitals. Indeed, some of our clinical men are now making most valuable contributions. Every medical man should have much of the spirit of research. It is the pabulum on which medicine feeds and without it the profession atrophies and starves. It is the glory and strength of the profession that it is not bound by dogma and pays no heed to ipse dixits. I have no sympathy with the idea that medical research should be

largely relegated to special non-teaching institutions. These have their function and we rejoice in their foundation and support and hope that they may multiply, but the man who is devoid of the spirit of scientific investigation has no place in medicine as student, practitioner or teacher, and the most elaborate medical training without opportunity for scientific observation is barren. Besides, opportunities for medical discovery should be widely distributed. Science makes no provision for an aristocracy. There can be no papal bulls issued in the domain of medicine. The workers must be many, all must be free to pursue knowledge in their own way, and all must be compelled to prove their claims, for "life is short, art is long, opportunity is fleeting, experiment fallacious and judgment difficult."

In this work of self-improvement the profession has had the aid of the more intelligent law-makers and administrators. In carrying out these progressive changes there has been much sacrifice of money and personal pride by many members of the profession. Large schools have willingly submitted to marked reduction in the numbers of their students and consequently in financial support. A medical education costs more in time and money than that demanded by any other profession, and the emoluments of the average practitioner have decreased as preventive medicine has become more effective. No other profession pays so heavily the great cost of eradicating the infectious diseases, but this is the function of medicine and no sacrifice should be regarded as too great. While intelligent medical men have been leading the crusade against greed, ignorance and disease, our legislative halls have been crowded with the representatives of sects, cults and charlatans demanding legal recognition. If I mistake not, herculean efforts will be made in the near future to lower the standards demanded of the medical practitioner. These endeavors have been promised aid from those who have heavy financial backing, but if we are worthy of the trust which we bear, we shall not yield. We must appeal to the good sense of the people for whose welfare we labor. We must show what scientific medicine has done for the public good and point out the greater things it may do with increased opportunity. It must be admitted that in the crusade for the restriction of tuberculosis many physicians have manifested but little interest. This is shown by their slowness to employ methods of early diagnosis and consequently by their failure to recognize the disease in its curable stage, also by their unwillingness to comply with the laws of notification. It is an undeniable fact that there are many medical men who know less about hygienic measures than the more intelligent of the laity. With advancing knowledge among the masses these professional fossils will be correctly labeled and properly shelved in the local museums of antiquities.

I believe that medicine is now attracting excellent young men. It should appeal to this class. It does not point the way to great financial reward, but it offers a service unsurpassed by any other calling. The historian tells us:

> For the Roman patriot the only worthy stage was the forum or the battlefield; every other pursuit was left in the hands of slaves and could not free itself from the taint of servitude.

Modern medicine offers a field in which the advancement of knowledge, the improvement of health conditions and the saving of lives are the measures of success.

Preventive medicine, still in its youth, has accomplished great things. As I have stated, within the past thirty years in this country the mortality from tuberculosis

has been reduced more than half and with scarlet fever and diphtheria the results have been more striking. Within the past ten years the average life has been increased four years. Great epidemics which once devastated continents are no longer known in the more intelligent parts of the world. In fact, it may be said that the death-rate is now an excellent measure of intelligence. In 1911 the death-rate in London was 15 per one thousand, while that of Moscow was 27.3. Preventive medicine is the keystone of the triumphal arch of modern civilization, and its displacement would precipitate mankind into relative barbarism. Should the health administrators of any great commercial center fail, for even a few months, to exercise the function of restricting disease, the history of the epidemics of the middle ages might be repeated. Great things have been done, but greater tasks lie before us, and their accomplishment depends on the scientific wisdom of our profession and the intelligence of the people. Without the harmonious adjustment of these forces the greatest efficiency can not be secured. While the mortality from tuberculosis has been reduced half in the past thirty years, we must not assume that the total eradication of this disease will be accomplished in the same number of years. Only the more progressive members of the profession have taken the initiative, and only the more intelligent members of the community have responded. Intelligence and the sense of moral responsibility must grow as the work proceeds. It remains for all who have the welfare of the race at heart to plan wisely and carry forward courageously the campaign against greed, ignorance and disease.

The sanitarians of this country seem to be in harmony in regard to the general procedures to be followed. These are embodied in bills recently introduced in the legislative assemblies of a number of states. In New York an excellent bill was passed and its operation is now being inaugurated under the directorship of Dr. Biggs, whose long and effective service in the city of New York demonstrates the wisdom of his selection. I regard it as highly fortunate that the operation of this new and important law is to be directed by one so well qualified.

My own ideas are embodied in the "Amberson bill" of the Michigan legislature of 1913. Among the provisions of this bill the following may be mentioned: The state is to be divided into health districts. In each such district a health commissioner is to be appointed for a term of four years. The fitness of the commissioner is to be determined by the State Board of Health after examination. The salary of the commissioner varies with the population of the district, but in most instances would run from three to six thousand dollars. There is to be an additional appropriation for laboratory expenses and for carrying out the purposes of the act.

It shall be the duty of the health commissioners to be vigilant in the work of disease prevention and the conservation of the public health, and to enforce all health laws of the state and health ordinances of their respective localities, together with all rules and orders of the state board of health; to collect and report to the state board of health morbidity statistics and to make a monthly report of the work done by them in narrative form to the state board of health and in such tabular form as may be prescribed by the state board of health. Copies of such reports shall be retained by each commissioner in permanent record books. They shall make such sanitary inspections and surveys of the district as may be required from time to time by the state board of health or by the city for which appointed, or by resolution of the board of supervisors of each county. They are hereby authorized and invested with the power to enter on and inspect private property at proper times in regard to the possible presence, sources or cause of

disease, to establish quarantine and in connection therewith to order whatever is reasonable and necessary for the prevention and suppression of diseases; to close schools, churches, theaters, or any place of public assemblage, to forbid public gatherings in order to prevent or stay epidemics; to collect statistics concerning insanity, feeblemindedness, tuberculosis and other infectious diseases; to inspect slaughter-houses and markets of all kinds where food is sold. They shall inspect at least once each six months and make a sanitary survey of the publicly owned buildings and institutions within their respective jurisdiction and shall keep a report thereon as part of the records of their office. They may inspect any school buildings or grounds within their jurisdiction as to sanitary conditions and shall have power to close any school when the sanitary conditions are such as to endanger or imperil the health or life of the pupils attending the same. They shall include all such sanitary inspections in their monthly reports to the state board of health. They shall at all times be subject to the orders of the state board of health in the execution of the health laws of this state and may perform any duty where required by the state board of health, or any member of said board acting for the entire board, which might be performed by said board of health or an officer thereof.

Further duties of the health commissioners are defined in the bill, and I have given only enough to show the purpose and scope of its provisions.

The successful operation of such a law would require the highest class of sanitarians. They must possess intelligence, industry and integrity. They must be devoted to their work, remembering that the Father of Medicine said:

> Where love of mankind is, there also is love of art.

With these qualifications I believe that such a law might be operated with great benefit to the people. Is the medical profession of this country prepared to do this work? I believe that many of the recent graduates of our best schools are fitted for this highly important function. They may need special training in the courses in public health now being inaugurated. If I mistake not, our profession will soon have wide opportunity to demonstrate its usefulness in this direction. If the public makes this demand, preventive medicine will have the opportunity to do a patriotic service which has never come to any profession at any time. With proper facilities and helpers, such commissioners might within a few years become acquainted with the conditions surrounding every permanent resident within his jurisdiction, and with properly qualified administrators of the law much might be done to abate disease, improve health, increase efficiency, eradicate the venereal diseases, stamp out vagrancy, pauperism, prostitution, alcoholism and crime. Crime is a disease due to heredity or environment, one or both. We now permit it to breed and multiply in our midst. Its causes must be determined and eliminated and its habitations must be discovered, disinfected or destroyed. We have heard too much about the rights of the individual; let us know more about his duties. Too much stress has been laid on the sacredness of private property and too little on the duty of all to contribute to the welfare of the whole. Preventive medicine has demonstrated in a practical way the force of the biblical statements that no man liveth to himself alone, and that every man is his brother's keeper. Preventive medicine is the most potent factor in the socialistic movement of the day with which every good man feels himself more or less in sympathy; besides it is at the same time the most powerful weapon against the anarchy with which some would threaten us.

If preventive medicine is to bestow on man its richest service, the time must come when every citizen will submit himself to a thorough medical examination once a year or oftener. The benefits which would result from such a service are so evident to medi-

cal men that detail is not desirable. When recognized in their early stages most of the diseases which now prevail are amenable to treatment. The early recognition of tuberculosis, cancer, diabetes, nephritis, heart disease, etc., with the elimination of the more acute infectious diseases would add something like fifteen years to the average life, besides saving much invalidism and suffering. The ultimate goal of science is the domination of the forces of nature and their utilization in promoting the welfare of mankind. Science must discover the facts and medicine must make the application for either cure or prevention.

The local health authorities for which the bills referred to make provision must be supervised by State Boards of Health or State Commissioners. Many of our State Boards of Health are already doing much, but this is little compared with what they might do. They should be absolutely free from party dictation, should be made up of men both qualified and interested and their executive officers should be distinguished for their knowledge of sanitation. Their appropriations should be greatly increased, for health is a purchasable commodity. Pure water, pure food and even pure air cost money, but they lead to health, which is worth more than gold to both the individual and the state.

Our present national health service is doing most excellent work. It demonstrated its strength in eradicating the plague in California and the suppression of yellow fever in New Orleans. It has charge of the administration of the laws affecting the admission of immigrants, so far as their health is concerned, and it performs this service well. The Public Health Service is now investigating the pollution of certain rivers, studying trachoma in the mountains of Kentucky, pellagra in South Carolina and the spread of typhoid fever in certain districts. The Hygienic Laboratory at Washington has made valuable researches in addition to the routine work of the examinations of vaccines and serums. This bureau should be developed into a department with a member in the cabinet. The study of contagion in our midst is quite as important as anything within the range of the activities of the Departments of the Interior, Agriculture and Commerce and Labor. Our health relations with other nations concern us quite as much as our trade relations. The one thing above all others against which our doors should be shut is disease, whether it be of plant, animal or man, whether it be of body, mind or morals. The highest function of the state is not to make millionaires out of a few importers or to find profitable investments for its surplus wealth in foreign lands, but to advance to the highest degree the health, intelligence and morality of its citizens.

In each state there should be a hygienic laboratory equipped with able men supplied with facilities for the study of sanitary conditions and for the prosecution of scientific research. The Hygienic Laboratory at Washington should be developed into a great institution for research which would improve the conditions of life. The greatest asset of any nation is the health of its citizens and the people who secure this in the highest degree will dominate the earth for the dominion of the superman, when he comes, will extend from pole to pole, not by force of arms, but by example and education.

Younger members of the profession: One who is soon to be mustered out of service, on account of disability and old age, salutes you. An old soldier who has served in the ranks for nearly forty years steps from his decimated regiment, lifts his cap and cheers you, as you pass by in your new dress and armed with weapons of greater efficiency

than were known when he enlisted. The cause is the liberation of the race from the bonds of superstition and ignorance and it is a glorious one. The contest began before the genus *homo sapiens* came into existence. Countless generations have served their time, some well, some ill, and have passed into oblivion, but their partial victories have made you stronger and placed on you a greater responsibility. Your intelligence is greater, your judgment is sounder and your effectiveness has been increased. Where the past has failed or only partially succeeded, your success will be greater. But the battlements of ignorance still bristle with heavy-fire guns. Only a few of the outposts of the enemy have been captured. It is for you to do and then like all your predecessors to die. You stand to-day within the firing-line. Go on courageously and when eons of the future have become the past, the superman, born out of the struggles of his predecessors, will demolish the last citadel of ignorance and vice, and firmly plant on the highest peak of the mountain of knowledge the flag of human progress and when the silken banner shall unfold, there shall appear on it this legend:

Pro gloria omnium nationum et hominum honore.

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A FOSSIL HUMAN SKELETON FROM GERMAN EAST AFRICA

AT a meeting of the *Gesellschaft naturforschender Freunde* in Berlin on March 17, 1914, Dr. Hans Reck made a preliminary report on a discovery that is of special interest to anthropologists. Dr. Reck was attached to a geological expedition that had been sent out to survey a parallel running through the northern end of German East Africa, as well as to collect for the Geologic-Paleontologic Institute of the University of Berlin and the Paleontological Museum at Munich.

The discovery in question was made in Oldoway hollow or gorge on the eastern margin of the Serengeti steppe. The Oldoway gorge lays bare a series of tufaceous layers that had been deposited in a freshwater lake. Five deposits can be distinguished stratigraphically as well as paleontologically. In the lowest deposit fossil remains are rare, the chief specimen being a part of a rhinoceros skeleton. The second deposit is rich in fossil mammalian remains, including the human skeleton. Remains of two types of fossil elephant, both different from the living *Elephas africanus,* were especially abundant; the skull of a hippopotamus was also found in deposit number two. Bones of the antelope appear for the first time in the third deposit, which also contains bones of the elephant. Elephant remains are dominant in the fourth deposit; fish bones are also abundant. The fifth and latest of the deposits is the richest of all in fossils. It is characterized by an antelope and gazelle fauna similar to that now living on the Serengeti steppe. In this deposit Reck found no elephant remains.

The change in fauna represented by the series corresponds to a change in climate. The climate of the upper horizon was similar to that of to-day; while the elephant, rhinoceros, hippopotamus, crocodile, and fish of the lower horizons bespeak a damp woodland climate that was probably synchronous with the Würm glacial epoch in Europe.

The human skeleton, as has been said, came from the next to the lowest horizon (No. 2). It is not only in a good state of preservation, but is likewise practically complete. The skeleton was found some three or four meters below the rim of the Oldoway gorge, which here is about fifty meters deep. The skeleton bore the same relation to the stratified bed as did the other mammalian remains and was dug out of the hard clay tuff with hammer and chisel just as these were. In other words the conditions of the find were such as to exclude the possibility of an interment. The human bones are therefore as old as the deposit (No. 2).

An attempt to determine the age of the

human skeleton with any degree of accuracy must of course wait upon a further study of the geologic and paleontologic data as well as on a more thoroughgoing somatologic study of the skeleton itself. Dr. Reck is, however, already convinced that it antedates the so-called alluvial or recent period. The thickness of the deposits indicates a considerable lapse of time, especially when one recalls that at least two of the superposed deposits were laid down before the faulting occurred, and with it the drying up of the lake. The change in fauna from rhinocerous, hippopotamus and two types of elephant both different from the living African elephant, to a gazelle and antelope fauna is likewise proof of considerable antiquity. Judging from the photograph of the skeleton still in situ, the man of Oldoway gorge did not belong to the Neandertal, but rather to the Aurignacian type of man. In the absence, however, of industrial remains and even photographs in detail, any pronouncement as to racial affinities with known European Quaternary human remains would be merely a guess.

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THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH

A statement has been given out from the Rockefeller Institute for Medical Research to the effect that in order that further opportunities may be afforded for the more complete investigation of the nature and causes of human disease and methods of its prevention and treatment, Mr. John D. Rockefeller has just donated $2,550,000 to the Rockefeller Institute for Medical Research.

Of the sum just donated a part will be utilized to purchase additional land in New York City so that the Institute will have acquired the entire tract where its buildings are now located, between Sixty-fourth and Sixty-seventh Streets on Avenue A, extending through to East River—about four acres. The remainder will be used to erect and equip additional laboratories, buildings, and plant, and to insure the proper maintenance and conduct of the extended work.

This gift of $2,550,000 is in addition to a special fund of $1,000,000 which Mr. Rockefeller has provided in order that the institute may establish a Department of Animal Pathology. Dr. Theobald Smith, now professor of comparative pathology in Harvard Medical School, is to become director of the new department.

It will be the purpose of this branch of the institute's work to give special attention to the study of maladies such as hog cholera, foot and mouth disease, and diseases of poultry, which are of such immediate and practical concern to farmers, and the elimination of which is so important. This will be the first enterprise of this kind upon an adequate basis to be established in this country. The results of its work should eventually be of great value in improving the health of cattle and other farm animals.

Mr. Rockefeller's previous gifts to the institute had amounted to practically $9,000,000, exclusive of real estate in New York City, so that the endowment of the institute will now approximate $12,500,000.

The Rockefeller Institute will, with the new gift, now become the most amply endowed institution for medical research in the world. In 1902, when the institute was founded, there was not a single undertaking of the kind in this country. England had the Lister Institute, Germany the Institute for Infectious Diseases, France the Pasteur Institute and Russia the Royal Military Institute at St. Petersburg. Since 1902 a number of other research laboratories have been established in this country, including several in Chicago.

In addition to the laboratories there is connected with the institute a hospital with every improved facility for the treatment of patients afflicted with diseases at the time under special investigation. For the treatment and study of contagious diseases—a most important phase of the institute work—there is a separate building with isolated rooms.

The aims of the Rockefeller Institute and the lines along which its future work—upon

an even more comprehensive basis—will be conducted, are indicated by some of its practical achievements already accomplished, such as the serum treatment of epidemic meningitis; the discovery of the cause and mode of infection of infantile paralysis, the surgery of blood vessels through which blood transfusion has become a daily life-saving expedient; the safer method of administering anesthetics by intratracheal insufflation; the skin or luetic reaction and the cultivation of the parasite of rabies.

The scope of the work of the institute will be indicated by a list of the several special scientific departments which it maintains. It includes pathology, bacteriology, protozoology, biological chemistry, physiology and pharmacology, experimental biology, and animal pathology, besides the special hospital.

BEQUESTS OF MRS. MORRIS K. JESUP

MRS. MORRIS K. JESUP, who died on June 17, bequeathed $5,000,000 to the American Museum of Natural History and made other bequests to public institutions amounting to $3,450,000. In providing in her will for the American Museum of Natural History, Mrs. Jesup said:

> I give and bequeath to the American Museum of Natural History of the city of New York four million dollars ($4,000,000) as a permanent fund to be known as "The Morris K. Jesup Fund," the income, and only the income, to be used in the purchase of specimens and collections and the expenses incident to and incurred in assisting scientific research and investigation and publication regarding the same, which the trustees of the museum shall regard as in its interests.

In a codicil, added to her will three years after the will was drawn, an additional $1,000,000 is given to the museum. Morris K. Jesup, who died on January 22, 1908, became president of the museum in 1882, and devoted a large part of his time and energy to its interests. In his lifetime Mr. Jesup gave more than $1,000,000 to the museum, and under his will it inherited an additional $1,000,000.

Other public bequests made by Mrs. Jesup include the following:

Syrian Protestant College	$400,000
Yale University	300,000
Union Theological Seminary	300,000
Young Men's Christian Association	250,000
New York State Woman's Hospital	150,000
Williams College	150,000
Metropolitan Museum of Art	100,000
Presbyterian Hospital	100,000
Hampton Institute	50,000
Tuskegee Institute	50,000
Northfield School	25,000
Mount Hermon School	25,000
New York Zoological Society	25,000
New York Botanical Gardens	25,000
Memorial Hospital for Cancer	10,000
St. Luke's Hospital	10,000
Cooper Union	10,000

SCIENTIFIC NOTES AND NEWS

THE American Medical Association at its meeting at Atlantic City elected officers for the meeting to be held next year at San Francisco as follows: President, Dr. William L. Rodman, of Philadelphia; first vice-president, Dr. D. S. Fairchild, of Iowa; second vice-president, Dr. Wisner R. Townsend, of New York; third vice-president, Dr. Alice Hamilton, of Chicago; fourth vice-president, Dr. William Edgar Darnall, of Atlantic City; secretary, Dr. Alexander R. Craig, of Chicago, reelected; treasurer, Dr. William Allen Pusey, of Chicago.

AT the opening meeting of the American Medical Association, its gold medal was conferred on Surgeon General William Crawford Gorgas.

WESTERN RESERVE UNIVERSITY has conferred its doctorate of laws on Dr. Simon Flexner, director of the laboratories of the Rockefeller Institute for Medical Research.

AMONG the degrees conferred by Harvard University at its commencement exercises were the master of science on Dr. Milton J. Rosenau, professor of preventive medicine in the Harvard Medical School, and the degree of doctor of science on Dr. W. C. Sabine, professor of physics and dean of the graduate school.

DR. WILLIAM L. DUDLEY, dean of the medical department and director of the chemical

laboratories of Vanderbilt University, Nashville, Tenn., had conferred upon him the degree of LL.D., by the University of Cincinnati, at its recent commencement.

Miss Ellen Churchill Semple, of Louisville, Ky., author of works on anthropogeography, has received the Cullom Medal of the American Geographical Society.

The University of Paris has approved the nomination of Professor James Rowland Angell, head of the department of psychology, and dean of the faculties of arts, literature and science in the University of Chicago, as lecturer at the Sorbonne in 1915.

A Martin Kellogg fellowship in the University of California has been awarded to Mr. C. E. Adams, government astronomer of New Zealand, who will carry on research work at the Lick Observatory.

Norman R. Blatherwick, Ph.D. (Yale), has been appointed assistant chemist at the Montefiore Home in New York City.

Mr. C. M. Means, electrical engineer, Pittsburgh, Pa., has been appointed consulting electrical engineer with the U. S. Bureau of Mines.

Professor H. Hergesell, of Strassburg, has been appointed director of the Royal Prussian Aeronautical Observatory at Lindenberg, near Berlin.

Dr. Edward A. Spitzka has resigned as professor of anatomy at Jefferson Medical College. He plans to take up the practise in New York City of his father, the late Dr. Charles Edward Spitzka, who died last January.

Professor J. Miller Thomson, F.R.S., is retiring at the end of this session from his position as vice-principal of King's College, London, and head of the chemical department of the college, after a service of forty-three years.

The Museum of Zoology, University of Michigan, will have a field party in the Davis Mountains, Texas, during July and August. The members of the party, Miss Crystal Thompson, of the museum, and Miss Myra M. Sampson, Smith College, will study the ecological distribution of the reptiles, amphibians and certain groups of invertebrates, principally the butterflies, molluscs and crustaceans.

Dr. Frederick W. True, assistant director of the Smithsonian Institution, known for his contributions to zoology, especially of the Cetacea, died on June 25 in Washington at the age of fifty-five years.

Dr. George Dean, professor of pathology in the University of Aberdeen, died on May 30 at the age of fifty years.

Professor Hugo Kronecker, of Bern, distinguished for his contributions to physiology, died on June 6, at the age of seventy-five years.

Professor Adolph Lieben, emeritus professor of general and pharmaceutical chemistry in the University of Vienna, died on June 6, aged seventy-eight years.

The International Congress of Anatomy will hold its next meeting at Amsterdam in August, 1915.

The interest of Lady Huggins, the widow of the late Sir William Huggins, in the higher education of women in science as developed in the United States has been shown by her gift to Whitin Observatory of Wellesley College of certain of her more personal astronomical possessions. The gift includes two stained glass windows once in Tulse Hill Observatory House, a beautifully wrought Arabian astrolabe, pocket sun dials of the eighteenth century, several exquisite portable instruments especially made for Lady Huggins, and a grating ruled and presented to Sir William Huggins by Rutherford, of New York, and used in his earlier work. There are also interesting pictures, drawings and books. These are properly placed in the Whitin Observatory to form a Huggins memorial collection. The astronomers from Harvard College Observatory and the Astronomical Laboratory were present at the formal presentation and Professor E. C. Pickering made an address.

The Smith-Lever bill, an act to "provide for cooperative agricultural extension work between the agricultural colleges in the several states receiving the benefits of an Act of Congress approved July 2, 1862, and of acts

supplementary thereto," has been passed by Congress and approved by the President. The act makes available for the next nine fiscal years an aggregate sum of $23,120,000 of federal funds to be expended in instruction and practical demonstrations in agriculture and home economics. To obtain this total the states must appropriate for like purposes a total of $18,800,000. Thereafter the government is to appropriate $4,580,000 annually, and the states to take their full quota must appropriate $4,100,000 annually. The purposes for which the funds are to be expended are defined by the act as follows: "That cooperative agricultural extension work shall consist of the giving of instruction and practical demonstrations in agriculture and home economics to persons not attending or resident in said colleges in the several communities, and imparting to such persons information in such subjects through field demonstrations, publications and otherwise; and this work shall be carried on in such manner as may be mutually agreed upon by the Secretary of Agriculture and the state agricultural college or colleges receiving the benefits of this act." Beginning with the year 1914–15 the act appropriates $10,000 to each state as a basic fund for each fiscal year. The act then appropriates additional federal moneys to be distributed among the states according to the percentage that the rural population of each state bears to the total population of that state. To share in the additional funds the state must duplicate the money received from the government in appropriations for the same purpose. According to the *Cornell Alumni News* from which the above is taken the amounts available to the College of Agriculture at Cornell, based on the percentage of rural population in New York State, will begin next year with the basic $10,000 granted each year, and will increase annually according to the following table: 1915–16, $33,443; 1916–17, $52,979; 1917–18, $72,515; 1918–19, $92,051; 1919–20, $111,587; 1920–21, $131,123; 1921–22, $150,659; 1922–23 and thereafter, $170,195.

A SOUTHERN GEOGRAPHIC SOCIETY has been established at Knoxville, Tenn., for the purpose of stimulating the interest of its members and of the public in the study and appreciation of the science of geography. It is planned to hold monthly meetings, on the second Friday evening, from October to May, inclusive, at which addresses or lectures will be given in which will be presented the results of studies, travels and researches pertaining to the science of geography, and related subjects. From time to time excursions will be conducted by the society for the study of features of geographic interest. One of the features in the plans of the society is that of a field school of geography and nature study, which it is proposed to conduct in connection with the Summer School of the South. Beginning with the summer of 1915 it is proposed to conduct at a suitable place in the mountains for a period of four to six weeks, a camp school for the study of geography and related subjects, including plants, animals, physiography, geology, forestry, etc. From day to day excursions will be made under competent instructors for the study of the flora, the fauna and the physical features of the region.

AFTER making investigations and collecting data for the last 12 years, the Ohio State Archeological and Historical Society has published an Archeological Atlas of Ohio which is the first book of this kind to be published by any state. Dr. William C. Mills, the curator of the museum of the society which is located on the campus of The Ohio State University, is the author of the book. A map of each county of the state, showing the mounds, village sites, rock shelters and other interesting archeological matter is the chief feature of the new book. Opposite each map is a description of the county. Other maps show the early Indian trails and towns, and the principal mounds and other earthworks of the entire state. The frontispiece is a photograph of the Serpent mound located in Adams county. Other photographs are included of the various forts, Indian trails and mounds which are described by the author.

IN a report on the Museum-Gates Expedition which investigated the culture of the ancient pueblos of the upper Gila River region

of New Mexico and Arizona, Dr. Walter Hough, of the U. S. National Museum, states that among thousands of interesting and valuable objects pertaining to the lives of the early inhabitants, many dried vegetables, fruits, and other perishable articles were found, as well as a desiccated turkey. In a cave which formed the rear chamber of a row of ruined stone abodes, on the banks of the Tularosa River, a tributary of the San Francisco River, the explorers found much material representative of the domestic life of the ancient dwellers. Upon excavation, this cave room yielded its treasures in sections as it were, different depths offering distinctly marked periods of occupation. Among the objects of importance was a brush made of grass stems bound in a round bundle, similar to those in use by the Pueblo Indians of to-day. During the habitation of this cave four burials had been made at different times, shown by the different levels from which the digging had been begun. In one corner near a rock mass some small bows and arrows, and other offerings were unearthed, indicating the location of an ancient shrine. From the rubbish and débris the remains of several mammals and birds were identified; among them, deer, pronghorn, bison, woodchuck, mice, rats, muskrats, rabbits, lynx, fox, skunk, bear, a hawk, an adult turkey, chicks and eggs, and many feathers of other birds, all of which occupied the cave at one time or another, or were killed and stored there by the early Indians. From early historical reports, it has been understood that the Pueblos raised turkeys, but the discovery of this desiccated adult and chicks proves conclusively that turkeys were kept in captivity, probably for their feathers, which were used in the manufacture of native garments. Ears and scattered grains of corn of a smooth and short grain, in yellow corn, blue and carmine but much faded with aging, were also found, as well as the remains and seeds of gourds, squashes, beans, other vegetables and fruits and nuts. In the Tularosa cave there was pottery of a rude form, while from several large open-air pueblos examples of a very fine finish and ornamentation were collected. The designs on the bowls commonly consist of four elements based on the world quarters, the bottom usually being circular and blank. Other designs are of combined hatched and solid color, or of a checkered variety. Many small collections of pottery were found in caves and springs where they had been deposited as offerings.

According to Ernest F. Burchard, of the U. S. Geological Survey, the total quantity of Portland, natural and puzzolan cement produced in the United States last year was the greatest in the history of the cement industry, amounting to 92,949,102 barrels, valued at $93,001,169, compared with 83,351,191 barrels, valued at $67,461,513, in 1912. The total production of Portland cement in 1913 as reported to the Geological Survey was 92,097,131 barrels, valued at $92,557,617; the production for 1912 was 82,438,096 barrels, valued at $67,016,028. The quantity of Portland cement produced, 92,097,131 barrels, is equivalent to 15,623,620 long tons. Compared with the production of pig iron for 1913, which was 30,966,301 long tons, the Portland cement production is nearly 50.5 per cent. of the quantity of pig iron. Of the 113 producing plants in the United States in 1913, 23 were in the state of Pennsylvania, whose output was 28,701,845 barrels of Portland cement, the largest quantity produced by any one state. The second greatest production came from Indiana, with 10,872,574 barrels, and California was third, with 6,159,182 barrels. The natural cement produced in the United States in 1913 amounted to 744,658 barrels of 265 pounds each, valued at $345,889, compared with an output of 821,231 barrels, valued at $367,222, in 1912, a decrease in 1913 of 76,573 barrels and of $21,333 in value. Puzzolan cement was manufactured in 1913 at three plants in the United States, in Alabama, Ohio and Pennsylvania. The output of puzzolan and Collos cements in 1913 was 107,313 barrels, valued at $97,663, compared with 91,864 barrels, valued at $77,363 in 1912, an increase in quantity of 15,449 barrels and in value of $20,300. The United States has a comparatively small export trade in cement. In 1913 the

total quantity exported was only 2,964,358 barrels, most of which was Portland cement, valued at $4,270,666, compared with 4,215,232 barrels, valued at $6,160,341, in 1912.

UNIVERSITY AND EDUCATIONAL NEWS

THE gift of $400,000 to the Yale Medical School, recently announced, is from members of the Lauder family, of Pittsburgh, Pa., and Greenwich, Conn., to be known as the Anna M. R. Lauder Fund, in memory of the late Mrs. George Lauder. The chair of public health is to be endowed from the gift.

MR. RICHARD BEATTY MELLON, of Pittsburgh, has endowed a fellowship in internal medicine in the school of medicine, University of Pittsburgh. The fellow will be a resident of a Pittsburgh hospital and will work directly under the professor of medicine, Dr. James D. Heard. In addition, Mr. Mellon has provided funds for the purchase and maintenance of an electro-cardiograph apparatus.

OUTLINES of a graduate course in aeronautical engineering leading to the master of arts degree have been issued by the Massachusetts Institute of Technology. The aerodynamical laboratory on the new site has already been described. It contains a wind tunnel of sixteen square feet section which can be furnished with currents up to nearly forty miles an hour. Special forms of apparatus have been provided including an aerodynamic balance, a duplicate of that in the National Physical Laboratory at Teddington, England. A full battery of other needed instruments of precision has been installed in the laboratory. The courses will be under the general direction of Professor Cecil H. Peabody, head of the department of naval architecture and marine engineering, and will be conducted by Assistant Naval Constructor, Jerome C. Hunsaker, U. S. N., who is detailed for the service by the secretary of the navy. Courses in dynamics of rigid bodies and theoretical fluid dynamics will be given by Professor E. B. Wilson, Ph.D., professor of mathematics; in explosion motors by Joseph C. Riley, S.B., associate professor of heat engineering; while special lecturers will deliver courses in wireless telegraphy and meteorology.

NEW appointments and promotions in the Johns Hopkins University are as follows: In the Philosophical Faculty—Alexander G. Christie, M.E., associate professor of mechanical Engineering; Joseph C. W. Frazer, Ph.D., now associate, to be associate professor of chemistry; E. Emmet Reid, Ph.D., associate professor of organic chemistry; William B. Rouwenhoven, Dr.-Ing., instructor in electrical engineering; Walter F. Shenton, Ph.D., instructor in mathematics; Frank A. Ferguson, A.B., assistant in physics. In the Medical Faculty, in addition to the appointment of Theodore C. Janeway, M.D., professor of medicine, Herman O. Mosenthal, M.D., associate professor of medicine, Leonard G. Rowntree, M.D., now associate professor of experimental therapeutics, to be associate professor of medicine, Edwards A. Park, M.D., now associate, to be associate professor of pediatrics, Charles M. Campbell, M.D., now associate, to be associate professor of psychiatry, Hans Lieb, M.D., lecturer in pharmacology, Eli K. Marshall, Jr., Ph.D., now associate in physiological chemistry, to be associate in pharmacology, Benjamin B. Turner, Ph.D., now assistant, to be associate in pharmacology, George J. Heuber, M.D., now assistant, to be associate in surgery, Karl M. Wilson, M.D., now instructor, to be associate in clinical obstetrics, Roy D. McClure, M.D., now assistant, to be instructor in surgery, David M. Davis, M.D., now assistant in pathology, to be instructor in urology.

IN the department of anatomy, school of medicine, University of Pittsburgh, Dr. Ralph Edward Sheldon, associate professor of anatomy, for the last three years in charge of the department, has been made professor of anatomy and head of the department. Dr. Davenport Hooker, instructor in anatomy, Yale Medical School, has been appointed assistant professor of histology and neurology.

DR. WINIFRED J. ROBINSON, assistant professor of botany at Vassar College, has resigned this position to accept that of dean of

the Women's Affiliated Colleges of Delaware, at Newark, Delaware.

Albert G. Hogan, Ph.D. (Yale), has been appointed assistant in animal nutrition at the Kansas Agricultural Experiment station, Manhattan, Kansas.

At the University of Indiana Dr. Kenneth P. Williams has been promoted from instructor to assistant professor of mathematics.

Miss Susan Rose Benedict, Ph.D. (Michigan), has been made associate professor of mathematics at Smith College.

DISCUSSION AND CORRESPONDENCE

TYPES OF BIRD GENERA LIMNOTHLYPIS NEW GENUS

Some years ago in discussing the fixing of types for the genera of North American Birds the writer called attention in these columns to the fact that certain names would have to be changed if the principal of "type by subsequent designation" adopted by the International Zoological Congress were adopted. This view was opposed by Dr. J. A. Allen on the ground that in his interpretation of the Code a subsequent designation was not valid if the species designated was already the type of another genus. The point raised was one of such importance that it was placed before the International Commission for an opinion and this has just been rendered and the writer's stand has been endorsed. As the matter is one upon which many systematic workers have been in doubt, it seems desirable to call special attention to the decision.

Incidentally one genus of North American birds is left without a name by the operation of this ruling.

Helinaia Audubon, 1839, contained originally two species, the worm-eating warbler *H. vermivora* (Gm.) and Swainson's warbler, *H. swainsonii* (Aud.). The name has been used universally for the latter but the first designation of a type by Gray fixed it upon the former, and in spite of the fact that this was already the type of *Helmitheros* it thereby becomes the type of *Helinaia*, the latter name being thus a synonym of *Helmitheros* Rafinesque. As no other generic name is available for Swainson's warbler I would propose *Limnothlypis*[1] with *Sylvia swainsonii* Audubon as its type.

Witmer Stone

Academy of Natural Sciences, Philadelphia

MUTATION

In a recent number of Science Professor Edward C. Jeffrey[1] raises objections to the concept mutation upon the ground that the phenomena in *Œnothera lamarckiana,* which de Vries described as mutation, are not mutation, this species being, as Bateson long ago suggested, a hybrid form. There seems to be about as much cogency in this argument as there would be in the claim that metagenesis is not a true concept because in *Salpa,* the form in which de Chamisso[2] first discovered it, it does not exist.[3]

The distinction between heritable variations (mutations, stable variations, "discontinuous"[4] variations) and non-heritable variations (fluctuating, unstable, "continuous"[4] variations) seems to be clearly established experimentally, and the interpretation of the former as germinal and the latter as somatic in origin, seems to have much in its favor.

Is not Professor Jeffrey's objection somewhat in the nature of a quibble?

Maynard M. Metcalf

A NEW LOCALITY AND HORIZON FOR PENNSYLVANIAN VERTEBRATES

Finds of Pennsylvania vertebrates are always interesting and important and are doubly

[1] λιμνη a marshy lake and θλυπις an ancient bird name.

[1] "The Mutation Myth," Science, XXXIX., No. 1005, April 3, 1914.

[2] A de Chamisso, "De animalibus quibusdum e classe Vermium linneana in circumnavigatione terrae," etc. Fasciculus primus, De Salpa. Berolini, 1891.

[3] W. K. Brooks, "Chamisso and the Discovery of Alternation of Generations," *Zool. Anzeiger,* Jahrg. 5, 1882.

[4] A poor term, for their heredity, not their degree of divergence from the parent stock, is the salient point.

so when the remains are not uncommon and well preserved. One of the writer's students, Mr. Carl Owen Dunbar, has recently discovered a new locality for vertebrates of this period. It is situated near the city of Lawrence and lies at the base of the Lawrence shales. The fossils occur in oblong or spherical siliceous nodules of which nearly one third contain bones and shells of value. Some are filled with small masses of many kinds of organic material and such are interpreted as coprolites, while others contain remains of fishes, crustacea, cephalopods and wood. There are no leaves and few invertebrates. The interesting and remarkable fact connected with the occurrence is the abundance of well-preserved vertebrate fossils. No less than eighteen partial or complete skulls have been collected and such have been found on the occasion of each visit. Three of the skulls show well-preserved casts of the brain. In addition there are many other complete bones, spines and scales.

The description of the vertebrates has been entrusted to Dr. R. L. Moodie, while the invertebrate and stratigraphic phases will be elaborated by Mr. Dunbar and the writer.

W. H. TWENHOFEL
UNIVERSITY OF KANSAS

EXISTENCE OF CROWN GALL OF ALFALFA, CAUSED BY UROPHLYCTIS ALFALFÆ, IN THE SALT LAKE VALLEY, UTAH

ON May 3 of this year, the writer found several typical specimens of alfalfa crown gall, caused by *Urophlyctis alfalfæ* (v. Lagerh.) P. Magnus, in the Salt Lake Valley, Utah. This disease, so far as the writer has noted, has been reported by Smith[1] in California, McCallum[2] in Arizona, and the writer[3] in Oregon. The presence of this disease in Utah may be of considerable importance in explaining many difficulties which alfalfa growers have had in maintaining profitable stands. In looking over the literature I do not note any report of its occurrence in the state of Utah, and, therefore, this note is published in order to record the presence of the disease in another locality. It is not yet known to what extent the disease has been injurious to alfalfa in the Salt Lake Valley, as its distribution has not been investigated.

[1] SCIENCE, N. S., Vol. XXX., No. 763, August 13, 1909.

[2] *Experiment Station Record,* Vol. 23, No. 7, December, 1910.

[3] SCIENCE, N. S., Vol. XXXVI., No. 928, October 11, 1912.

P. J. O'GARA
LABORATORY OF PLANT PATHOLOGY,
AMERICAN SMELTING AND REFINING CO.,
SALT LAKE CITY, UTAH,
May 14, 1914

RELIGIOUS TRAINING AT A UNIVERSITY

THE article on this subject on page 722 of SCIENCE for May 15 ought not to pass without a protest. The primary function of religion, as most thoughtful men see it, is not worship but the development of right purposes and right ideals in the conduct of life—especially the development of the ideal of service. Nothing stands out more clearly in the teachings of Christ than the thought that worship and ritual are worse than useless unless they contribute to this end.

The statement that "a few are interested in religion, but all of us in education" is, to say the least, misleading. Educational men are apt to be very reticent about religious matters and superficial observers are liable to conclude that their opinions are colorless, but a little inquiry will reveal the fact that a large proportion of both students and faculty are members of Christian churches. In the state university with which I am best acquainted 45 per cent. of the students are members of such churches and 79 per cent. register as adherents of some church. A large majority of the faculty are adherents of churches.

It is true that the fundamental virtues have been long known, as Buckle says, but many of us think that it is also true that there is great need of bringing these virtues forcibly to the attention of men and women at frequent intervals throughout their lives. As our civilization is now constituted the agency which per-

forms this service most effectively for the bulk of our people is the Christian church.

Nearly all Americans will agree that the separation of church and state has been to the advantage of both and that it is not the function of a state university to teach religion. At the same time the faculties of our state universities ought to be in the heartiest sympathy with those who are carrying on religious work among the students and as individuals they should take an active part in work of this character.

W. A. Noyes

University of Illinois

SCIENTIFIC BOOKS

Handbuch der Vergleichenden Physiologie. Herausgegeben von Hans Winterstein. Jena, Gustav Fischer. 1910 et seq. Each part contains about 100 pp. Price unbound 5 Marks.

In Science, August 12, 1910, p. 211, there appeared a notice of the publication of the earlier parts of Winterstein's comprehensive "Handbuch," begun in 1910. Since that time numerous parts have continued to be issued until at the present moment more than 42 are available. For reasons which are doubtless defensible on the part of the editor and publisher, but not obvious or convincing to the subscribers, the text is being issued in fragments, prepared successively or simultaneously by different authors on quite unrelated topics. In this way a great delay ensues until the individual monographs are completed; and still more time elapses before the volumes can finally be bound in the form intended for them. These are drawbacks which seriously impair the usefulness of any book of reference, especially at a period when the literature of the natural sciences is growing with leaps and bounds.

It would be futile for a reviewer to attempt any detailed reference to a cyclopedic work of this character, even if one individual competent to offer critical opinions upon so great a diversity of topics were available for the task. The best indication of the scope and importance of this scientific-literary undertaking is afforded by the mention of the many well-known biologists and physiologists who are cooperating in it. The list of collaborators now includes the following: E. Babak (Prag), S. Baglioni (Sassari), W. Biedermann (Jena), R. du Bois-Reymond (Berlin), F. Bottazzi (Naples), E. v. Brücke (Leipzig), R. Burian (Naples), R. Ehrenberg (Göttingen), L. Fredericq (Liege), R. F. Fuchs (Breslau), S. Garten (Giessen), E. Godlewski (Krakow), C. v. Hess (Munich), J. Loeb (New York), E. Mangold (Freiburg), A. Noll (Jena), H. Przibram (Vienna), J. Strohl (Zürich-Naples), R. Tigerstedt (Helsingfors), E. Weinland (Erlangen), O. Weiss (Königsberg), H. Winterstein (Rostock).

Among the completed volumes is one (III. 2) upon the metabolism of energy and the physiology of changes in form, in which chapters upon animal heat (Tigerstedt), the production of electricity (Garten), the production of light (Mangold), animal form (H. Przibram), and reproduction (Godlewski, Jr.) are included. Volume IV. deals with the physiology of irritability, conductivity, etc.—phenomena of the nervous system. For this a chapter on tropisms has been prepared by Jacques Loeb. The first half of Volume II. is devoted to the classic compilation of Biedermann upon the ingestion, alimentation and absorption of food by the invertebrates. This alone is a most extensive monograph, the exhaustive character of which is represented in nearly a thousand pages, with 200 illustrations and about 1,200 references. Volume I. is to deal with the fluids and tissues, and with the comparative physiology of respiration.

The foregoing comments give a very imperfect idea of the contents of many hundreds of pages of illustrated text—an invaluable cyclopedia in a field which has hitherto not afforded any such elaborate systematic compilation.

Lafayette B. Mendel

Sheffield Scientific School,
Yale University

Kristallberechnung und Kristallzeichnung. By B. Gossner. Leipzig und Berlin, Wilhelm Engelmann. 1914. Pp. viii + 128;

1 plate; 109 figures in text. Price, 8 Marks.

During the last fifteen years the older rather tedious and somewhat intricate methods for the calculation and drawing of crystals have been greatly simplified by the contributions of Goldschmidt, Penfield, Wulff and Hutchinson especially. The purpose of the present text is to bring together these various methods in a clear and concise form in a single treatise.

The general part of the book comprises sixty-six pages and includes a discussion of the stereographic, gnomonic and linear projections and the development of general formulas for the calculation of crystals. The use of the protractors of Hutchinson and Penfield are described at length, as is also the stereographic net of Wulff. All possible cases of crystal-calculation are then taken up fully in a discussion extending over twenty pages.

The special part of the text, consisting of sixty-one pages, is devoted (*a*) to the application of the methods of crystal-calculation, examples being introduced for each system; and (*b*) to crystal-drawing. Here the methods for the drawing of crystals directly from stereographic and gnomonic projections are given first. These are followed by those involving the use of the axial cross for the projection of simple and twinned crystals.

The treatment throughout the book is concise but clear, and illustrated with 109 diagrams. There is also a bibliography of the most important texts and papers on the subject. The book is a valuable contribution and all advanced students of geometrical crystallography should have access to it.

EDWARD H. KRAUS

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UNIVERSITY OF MICHIGAN

The Electrical Conductivity and Ionization Constants of Organic Compounds. By HEYWARD SCUDDER, B.A., B.S., M.D. New York, D. Van Nostrand Co. 1914. Pp. 568. Price $3.00.

In the words of the author, "the object of this book is to present as far as lies in my power a bibliography of all the measurements of the ionization constants and the electrical conductivity literature between the years 1889 and 1910 inclusive, together with the values of the ionization constants, and certain values of the electrical conductivity measurements. Qualitative work is also included. . . . From 1910 to the beginning of 1913, important corrections that have come to my notice have been inserted."

As to arrangement: "The book is divided into a set of tables arranged according to the names of the compounds, containing all the data that may be given with a bibliography of all references to each compound; a formula index to the compounds; a bibliography arranged according to the names of authors; a subject index to certain subjects; and a journal list giving the names of all journals examined with the number and date of the last volume examined."

The first set of tables will show the values, if known, of the specific conductivity of the pure substance; the ionization constant; the conductivity in aqueous solution; the conductivity in solvents other than water; the conductivity under various conditions as to temperature and pressure and in various mixtures; the conductivity of the salts at many different temperatures and in many different solvents.

The vast amount of labor that the author must have expended upon this compilation will be greatly appreciated by workers in this field of physical chemistry. As the variation in the expression for the dilution law lately suggested by Kraus and Bray is likely to awaken a new interest in conductivity values and ionization constants, the book should prove to be of much service.

The list of errata is wonderfully small considering the nature of the work.

E. H. ARCHIBALD

NOTES ON METEOROLOGY AND CLIMATOLOGY

"THE Rainfall of California," by Professor Alexander McAdie (Univ. Calif. Geogr. Pub., Vol. 1, No. 4, pp. 127–240, Pls. 21–28). This

recent publication is a thorough treatment of the complex rainfall conditions of California. The chief factors controlling rainfall there are centers of action ("hyperbars and infrabars"), prevailing surface drift, ocean effect, topography and ocean currents (including upwelling cold water[1]). The influence of the positions of the centers of action may be summed up in this general law: "Typical wet winters on the California coast occur when the North Pacific low overlies the continent west of a line drawn from Calgary to San Francisco. Typical dry winters are associated with a westward extension of the continental high to the coast line and a retreat of the Aleutian low to the northwest." The prevailing surface drift of the atmosphere is northwest in summer but southerly and westerly in winter. In winter, these winds from the Pacific Ocean supply ample moisture for rainfall where topography causes them to rise. The complexity of ocean currents and ocean temperatures on this coast may locally affect rainfall.

The rainfall resulting from the combination of these factors is moderate to heavy (more than 2,000 mm.) on the west slopes of the coast ranges and Sierra Nevadas, but light on the east side. On the west slopes of the Sierras from the floor of the Great Valley to an altitude of 1,500 meters, the rainfall increases on the average about 75 mm. per 100 meters of ascent. Above 1,500 meters, the rainfall seems to decrease slightly with altitude. The rate of decrease of rainfall with decreasing altitude down the east slope is variable, depending on the height and the rainfall of the mountain crest. On the line of the Central Pacific Railroad, the rainfall decreases 147 mm. per 100 meters of descent. In southern California, the zone of maximum rainfall is much higher, and the rate of increase with altitude is about 50 mm. per 100 meters up to 2,500 m. The details of California rainfall are shown in comprehensive tables.

Parts of California are subject to excessive rains. These rains are of the cloudburst type in the drier areas. In the wetter portions, the excessive rains are less intense but of greater duration. A large table of excessive precipitation is given. In the high mountains, snowfall, so important for irrigation and water-power, is very heavy. Special attention is paid to the snowfall and melting of snow on the ground at Summit (alt. 2,138 m.). The average annual snowfall there is more than 1,000 cm. Tamarack, a station at 2,438 m. altitude, has an even heavier snowfall. In the table, a snowfall of 2,260 cm. is indicated in the winter of 1906–07. The record maximum for any month was 998 cm. in January, 1911. The rainfall of San Francisco is treated in detail at the end of the memoir.[2]

THE MONTHLY WEATHER REVIEW

THE *Monthly Weather Review* with the January, 1914, issue has reverted to the more or less popular form it had until July, 1909. The material is classified under the heads (1) Aerology, (2) General Meteorology, (3) Forecasts and General Conditions of the Atmosphere, (4) Rivers and Floods, (5) Bibliography, (6) Weather of the Month. Some of the articles in the January and February numbers are briefly considered below.

Lorin Blodget's "Climatology of the United States": An Appreciation. By Robert DeC. Ward. (Pp. 23–27.) This great work, a pioneer in its field, receives deserved praise and attention in this article. Professor Ward quotes many of the happy and vivid descriptions of the climate of the United States and its human effects which are as valuable to-day as ever. Evidently little has been added to our knowledge of the general conditions and controls of the climates of the United States in the last fifty years. The advance has been chiefly in the study of the details.

"The Meteorological Aspect of the Smoke

[1] This upwelling is most marked in summer and is caused by the strong northwest winds of the great North Pacific high: G. F. McEwen, "Peculiarities of the California Climate," *M. W. R.*, January, 1914, pp. 14–23. See also, W. G. Reed, "The Japan Current and the Climate of California," *M. W. R.*, February, 1914, pp. 100–101.

[2] *Cf.* also W. G. Reed, "Variations in Rainfall in California," *M. W. R.*, November, 1913, pp. 1785–1790.

Problem." By H. H. Kimball. (Pp. 29–35.) On account of the usual smoke-blanket over cities, sunlight is diminished in intensity, and radiation is hindered. The effect is greatest in winter and in the early morning when the air circulation is slowest. The duration of fogs is increased by the presence of smoke because of the protection against sunlight and because of the actual coating of the particles with oil. On account of smoke and fog, higher minima and lower maxima temperatures occur in cities than in the surrounding country.

"The Effect of Weather upon the Yield of Corn." By J. Warren Smith. (Pp. 78–93.) The rainfall at the time of flowering of the corn and shortly thereafter (generally, the four weeks beginning the middle of July), is a great factor in determining the success or failure of the crop. In this period a few moderately heavy rains are most favorable. The rate of growth of the corn corresponds closely to the maximum temperatures. There are maps showing corn-acreage, dates of planting and harvesting, and the periods between these dates.[3]

ANTARCTIC METEOROLOGY

SOME of the meteorological results of Scott's last expedition are reviewed by Dr. J. v. Hann in the *Meteorologische Zeitschrift,* February, 1914 (pp. 62–67). Also a short review of an article by Prof. W. Meinardus is to be found in the *Scientific American,* April 25, 1914 (p. 347). Cape Evans (77° 35′ S., 166° 32′ E.) at the foot of the Ross Barrier, Cape Adare (71° 18′ S., 170° 9′ E.) on the west side of the Ross Sea, and Framheim (78° 38′ S., 195° 30′ E.) on the ice sheet not far southeast of the Ross Sea, are stations from which observations of some length are available. Winds of low velocity are most frequent for these three stations,—particularly for Framheim. The stillness of the atmosphere at Framheim is favorable to excessive cooling of the lower air. As a result, the annual temperature there was —24.4° C. (10 mo. obs., 2 mo. interpolated). The summer temperature was —7.3° and the winter temperature —37.8°. Cape Evans near the base of the Ross Barrier is subject to west-wind blizzards in which the wind is extremely gusty. Simultaneously, Cape Adare, a short distance north, experiences light southwest winds. This anomaly is apparently the result of the convectional circulation due to a large difference in temperature between the air at the top of the Ross Barrier and that over the Ross Sea. The dense cold air, thus forced over the cliff, makes an air-fall of great velocity (this phenomenon is known as the "bora" in Europe).

Atmospheric electricity is at a maximum in summer and at a minimum in winter, the reverse of the rule in middle latitudes. Nitric acid in rain(snow)-water is about the same in amount as that found in Europe. This fact is opposed to the idea that thunderstorms are largely responsible for the nitric acid found in rain water. The carbon dioxide content of air samples was 0.0205 per cent.—a striking contrast to the usual 0.03 per cent. of other parts of the earth. The samples from which these determinations were made were collected by Mr. R. E. Godfrey, of the Charcot Expedition, 1909–1910.[4]

NOTES

DR. HERGESELL, head of the Meteorological Institute of Strassburg, has been appointed to succeed Dr. Assmann as director of the Aeronautical Observatory at Lindenberg.

ON January 6, 1914, Dr. Nils Ekholm succeeded Dr. H. E. Hamberg as director of the Swedish Statens Meteorologiska Centralanstalt.

OBSERVATIONS of Messrs. Okada, Fujiwhara and Maeda indicate that thunderstorms may produce seiches in lakes. The change of pressure, impulsive action of the wind and rainfall seem to be the principal causes.[5]

[3] Detailed studies of plant growth as related to soil and meteorological conditions are in the course of preparation for an extensive atlas of American agriculture, under the direction of Mr. O. E. Baker, of the Bureau of Plant Industry.

[4] *Scientific American,* April 11, 1914, p. 304.

[5] *Nature,* April 30, 1914, p. 222.

The meteorological service of India is beginning aerological work with balloons sondes.

An extreme minimum temperature of —91.9° C. was recorded with a ballon sonde on November 5, 1913, over Batavia, Java. Another ballon sonde brought down a record of —90.9° at 17 km. altitude on December 4. Above this the temperature rose to —57.1° at 26 km.[6]

Pyrheliometric observations obtained from ballons sondes in California last summer at altitudes of 10 to 13 km. indicate a lower solar constant of radiation than is obtained from observations at the earth's surface after transmission corrections have been added. Although a maximum altitude of 33 km. was reached, no observations were secured above 13 km. because of the freezing of the mercury.[7]

The unpublished papers of the International Meteorological Congress held at Chicago in 1893 are now appearing in the *Monthly Weather Review*.

A conference of observers and students of meteorology and allied subjects will be held in Edinburgh, September 8 to 12, 1914.[8]

Charles F. Brooks
Harvard University,
May 18, 1914

SPECIAL ARTICLES

A CULTURE MEDIUM FOR THE TISSUES OF AMPHIBIANS

In the course of some experiments on the culture *in vitro* of tissues from various amphibians, considerable difficulty was encountered in using blood plasma as a culture medium on account of its very rapid coagulation. When working with the tissues of the frog or of tadpoles it was more convenient to use lymph taken directly from some of the subcutaneous lymph spaces. Preparations in lymph may frequently be made before coagulation occurs, but the lymph tends to become too watery for use a short time after the frog is killed, so that only a small quantity is available from any one animal. In most urodeles the scarcity of available lymph prohibits its employment, so that plasma was at first depended on almost entirely for a culture medium.

There is little outwandering or outgrowth from the tissues of either the embryos or the adults of amphibians unless the surrounding medium is of more or less solid consistency. Amphibian tissue will live for weeks in blood serum or even in Ringer's solution, but the cells do not often grow or wander away from the rest of the mass unless they come into contact with a substance that evokes a thigmotactic response. In searching for a convenient substitute for blood plasma the endeavor was therefore made to find a medium which would remain fluid while being used, but which would solidify to about the consistency of blood clot afterwards. After some experimentation it was found that a mixture of equal parts of blood serum and a two per cent. solution of Grübler's nutrient gelatine afforded a substitute that was very successful.

The preparation of the mixture is easy. Blood drawn from the heart is stirred with a fine glass rod and the coagulum removed. The blood is then centrifuged to remove the corpuscles, and the clear serum mixed with an equal quantity of a two per cent. solution of gelatine. The gelatine solution is previously boiled and precautions are taken to prevent contamination of any of the ingredients of the medium with bacteria. I have used the mixture after it had been kept for several days, and found it to be practically as good a culture medium as when perfectly fresh.

The mixture becomes fluid when warmed slightly and remains fluid for an hour or more after being cooled to ordinary room temperature. I commonly keep it in small tubes of glass, and by rubbing the tubes briskly with the fingers sufficient heat may be generated to cause the gelatine to liquify. Should the supply of culture medium solidify while one is putting up preparations, it is only necessary to warm it slightly to keep it fluid for an hour or more longer.

[6] *Nature*, March 5, 1914, pp. 5–6.

[7] C. G. Abbot, *Scientific American*, April 4, 1914, p. 278.

[8] See *Nature*, February 12, 1914, p. 667.

Making preparations of tissues is greatly facilitated by the use of this medium, and the comparatively constant composition of the mixture renders the results obtained through its use more uniform than those secured by the employment of lymph or plasma. The implanted cells get what very nearly corresponds to their natural food in the serum of the blood, and the gelatine, while apparently acting in no way injuriously to the cells, affords a means of appealing to their thigmotactic proclivities that is ordinarily supplied by the fibrin of clotted plasma.

The outgrowth of epithelium in this medium is remarkable. In some cases it has been over twenty times the superficial area of the implanted tissue. As a rule the tissues thrive better than in plasma or lymph. It is comparatively easy to subculture the tissues, since the gelatine dissolves in Ringer's solution, and by washing the preparations in this fluid they may be readily freed, and then transferred to a fresh culture medium. I have transferred pieces of epithelial tissue several times in succession, and kept them thriving for three months. Cell divisions have been repeatedly seen in epithelial cells in this medium. In a piece of tissue put up on February 17 and changed to fresh culture fluid three times afterwards, I observed several mitotic figures in epithelial cells on April 8, fifty days after the preparation was made. The chromosomes could be seen with great distinctness in the living material. In one cell first seen in the prophases of division, the chromosomes were seen to align themselves in the equatorial plate, then to be drawn apart, and finally to become constituted into the two daughter nuclei; at the same time the constriction in two of the cell body could be distinctly followed. Over a dozen other mitotic figures in various stages were observed in the same piece. The preparation had been washed in Ringer's solution and transferred to new culture medium a few days previously, after which it had taken on a new lease of life. The division figures were all seen in a transparent sheet of epithelium that had spread out in contact with the cover slip supporting the hanging drop culture.

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ON THE CHEMICAL NATURE OF THE LUMINOUS MATERIAL OF THE FIREFLY

OUR knowledge of the chemistry of light production by organisms may be summed up in the statement that phosphorescence is due to the oxidation of some substance formed in the cells of the animal. As with other oxidations, both water and oxygen must be present. If either water or oxygen are absent the photogenic substance will not be used up by oxidation. Luminous tissues if dried rapidly may be ground up and preserved indefinitely, and at any later time, if moistened in the presence of oxygen, will phosphoresce. This old and important discovery makes the investigation of the chemical nature of the luminous substance relatively easy. The dried powder of the luminous organ may be extracted with: (1) Oxygen-free watery solvents, or (2) water-free solvents (as ether, chloroform, etc.) with or without oxygen.

The earlier workers supposed the photogenic material to be phosphorus or phosphine. These views require no comment to-day. Later suggestions have been that the substance is a fat, an albumin, a lipoid (lecithin), a nucleoalbumin or a lecithoprotein (phosphatid). It is obviously desirable to know whether the substance is fat-like or protein in nature. The fact that phosphorescence ceases as soon as the moist luminous material is heated to 100° proves nothing, for, like organic oxidation in general, an oxidizing ferment is probably involved, and it is this oxidase which may be destroyed on heating.

I can state definitely that the "luciferin" of the common fire-fly is not a true fat or any fat-like body such as lecithin. The dried material may be extracted with anhydrous ether and the ether extract evaporated to dryness. On adding water or a watery extract of luminous organ (to add an oxidizing enzyme) or potato juice (to add an oxidase) to the residue no phosphorescence took place; on adding water to the original ether extracted

material brilliant phosphorescence occurred. The same results were obtained with anhydrous chloroform, ethyl alcohol, acetone and carbon tetrachloride. The material is therefore insoluble in fat solvents.

It is most likely a protein but belongs among the proteins insoluble in water. By means of a specially constructed apparatus I was able to extract with oxygen-free distilled water and to filter the extract in an oxygen-free space. On admitting air the filtrate did not glow, but the filter paper showed innumerable bright dots. The granules of luminous substance are therefore insoluble in water. A lack of material has prevented extraction with other protein solvents, salt solution, acids and alkalies.

E. Newton Harvey

Princeton, N. J.,

The American Chemical Society. II

Division of Fertilizer Chemistry

J. E. Breckenridge, Chairman

F. B. Carpenter, Secretary

Chairman's Address: *Chemistry an Important Factor in the Fertilizer Industry:* J. E. Breckenridge.

The Preparation of Neutral Ammonium Citrate: Ermon D. Eastman and Joel H. Hildebrand.

The proposed method depends on the preparation of a standard sodium phosphate solution of known hydrogen ion concentration and the comparison of the color produced by rosolic acid in this solution with that produced by the same indicator in the ammonium citrate solution to be tested. The normal ammonium citrate solution is shown by its hydrogen ion concentration to be slightly acid and the authors have therefore adopted the neutral rather than the normal solution.

A Comparison of Neutral Ammonium Citrate with Sodium Citrate and N/10 Citric Acid: Paul Rudnick, W. B. Derby and W. L. Latshaw.

Sodium citrate proposed by Bosworth (2) can be used as a substitute for the official neutral ammonium citrate, but N/10 citric acid obviates difficulties due to highly concentrated solutions, such as slowness in filtration, etc., and gives results which are in excellent agreement with those obtained by the official neutral ammonium citrate.

The Separation of Organic Nitrogen from Mixed Fertilizers: C. H. Jones.

The method recommended depends on separation by gravity in carbon tetrachloride. Tables giving the behavior of various fertilizer ingredients and their availability by the alkaline permanganate method are included.

Separation of Phosphoric Acid from Lime: F. K. Cameron.

A discussion of the solubility curves of potassium and ammonium phosphates and their applications to practical problems.

Separation of Potash from Kelp (lantern): F. K. Cameron.

An illustrated description of the kelp beds and the methods of harvesting so far developed.

Division of Pharmaceutical Chemistry

F. R. Eldred, chairman

A. P. Sy, Secretary

Methods of Analysis of the Forthcoming Pharmacopœia: H. W. Wiley.

Seasonal Variation in the Composition of the Thyroid Gland: Atherton Seidell and Frederic Fenger.

The experiments upon this subject embracing the period August, 1911, to August, 1912, have been continued for another one-year period beginning December 1, 1912. The evidence for the seasonal variation in iodine content of the thyroid gland has been confirmed, and additional data obtained, showing that a regular change of phosphorus and ash, varying inversely with the iodine, occurs. In regard to the fresh weight of the glands, the results indicated a regular seasonal change in the case of the beef and sheep, but not with the hog. The results demonstrate the practicability of a standard of 0.2 per cent. iodine in commercial desiccated thyroids.

Some Peculiarities of Present Food and Drug Laws: Frank O. Taylor.

Notes on the Determination of Antipyrine: George D. Beal and Duane T. Englis.

Antipyrine and caffeine can be easily extracted by chloroform from an aqueous solution three-fourths saturated with sodium chloride. If the liquid contains vegetable extractives, the extraction can be effected without emulsification by first precipitating the coloring matter, resins, etc., with lead acetate. The antipyrine may be titrated in the presence of caffeine by Bougault's[1] method,

[1] *Jour. Pharm. Chem.*, [6], 1, 161, 11, 97.

using an alcoholic solution of iodine, and adding at the same time an alcoholic solution of mercuric chloride, to take up the liberated hydriodic acid. One gram of antipyrine = 1.351 grams of iodine. The authors find that as effective a method consists in the substitution of an ordinary N/10 iodine solution for the alcoholic iodine solution, titrating in the presence of alcohol, and adding sufficient alcoholic mercuric chloride to combine with the hydriodic acid liberated and in addition enough to combine with the potassium iodide in the N/10 iodine solution. The results are accurate and the endpoint is distinct.

Further Notes on Lloyd's Reagent for Alkaloids: SIGMUND WALDBOTT.

In precipitating quinine from aqueous solutions of quinine bisulphate by means of Lloyd's reagent,[2] the filtrate upon evaporation yields crystals of calcium sulphate, due to the calcium contents of the reagent. When the CaO is completely removed by hydrochloric acid, the modified acid-free reagent, upon precipitating quinine from quinine bisulphate, yields free sulphuric acid in the filtrate. This demonstrates that the affinity of the reagent for alkaloid is strong enough to tear asunder the quinine bisulphate molecule.

Estimation of Phenacetin and Acetanilide in Admixture: W. O. EMERY.

Estimation of Antipyrin: W. O. EMERY AND S. PALKIN.

Estimation of Caffeine and Antipyrin in Admixture: W. O. EMERY AND S. PALKIN.

Estimation of Phenacetin and Salol in Admixture: W. O. EMERY, C. C. LEFEVRE AND G. C. SPENCER.

A Method for the Estimation of Podophyllum Resin: W. M. JENKINS.

Commercial Papain and its Testing: H. M. ADAMS.

Some Observations on the Leach Test for Coumarin: WILLIAM G. GAESSLER.

Digitalis Ash: CHARLES T. P. FENNEL.

The recognized importance of mineral constituents in plants, the elements of plant development—their equal importance to plant life—classification as air and soil groups—products of plant life—products of physiological processes not in the ash—foundation substances of the soil—the needs of proper soil to fit the plant for specific purposes—medicinal plants—history of the method of use—juices direct—watery extracts, alcoholic extracts—isolation of so-called active constituents—variations in therapeutic action—the preexistence and the generation of active constituents by manipulation of processes of extraction—digitalis and other plants—the ash—constituents—peculiarities—elementary decay—eka silicon—radioactive matter in rocks and soils—effect on plant life—experimentally.

[2] *Cf. Jour. Amer. Chem. Soc.*, June, 1913.

The Estimation of Morphine: H. M. GORDIN.

The Estimation and Variability of Alcohol in Galenicals: L. F. KEBLER.

Results of the Examination of Some Medical Agents in the District of Columbia: L. F. KEBLER.

Extraction of Morphine from Aqueous Solution: H. BUCHBINDER.

DIVISION OF INDUSTRIAL CHEMISTS AND CHEMICAL ENGINEERS

Geo. P. Adamson, Chairman

S. H. Salisbury, Jr., Secretary

Volumetric Determination of Sulphur in Iron Ore: L. SELMI.

The method is based on the ignition of the ore in a current of hydrogen and in presence of zinc (and animal charcoal if sulphates of lime and barium are present). The reduction is prolonged for about twenty minutes and the heat discontinued and the furnace cooled rapidly at room temperature while the hydrogen is kept going through the furnace. When room temperature is attained the reduced ore is transferred to an evolution flask and the H_2S evolved as in the case of iron and steel. Accurate results have been obtained in less than one hour, and this method is especially adapted for the determination of low sulphur in iron ores. The apparatus required is a fused silica tube, heated either by electricity or gas, a Kipp hydrogen generator and three gas washing bottles. On a number of determinations by this method I obtained the following sulphur results on the Bureau of Standards magnetite ore (standard .025 per cent.): .025, .026, .025, .024, .027, .025.

Pitot Tubes for the Measurement of Gas Velocities: ANDREW M. FAIRLIE.

Numerous instances are cited in which some method of accurately measuring gas velocities is needed. Errors appearing in recent publications on this subject are corrected. As a result of recent work, a type of Pitot tube is indicated, which chemical engineers may select and use, under certain conditions, with confidence. Features requiring further investigation are pointed out.

A Comparison of Various Modifications of the Kjeldahl and Dumas Methods for the Determination of Nitrogen in Coal and Lignite: A. C. Fieldner and C. A. Taylor.

The Mechanism of the Reaction between Phenolic Bodies and Active Methylenes: L. V. Redman, A. J. Weith and E. P. Brock.

Fluorescence of Petroleum Oils: Benjamin T. Brooks.

Engler and others consider that fluorescence of petroleum oils is due to colloid matter suspended or emulsified with the oil. Experiments of the author with the ultramicroscope showed that this can not be the case. Such fluorescent oils give no indication of electrophoresis. The fluorescent substance or substances readily form sulphonic acids, which are soluble in water and may be separated from the acid sludge tar obtained on treating with concentrated sulphuric acid. In general oxidizing agents destroy the fluorescent substance, but the action of nitro compounds as "deblooming" agents is purely physical. If an oil is debloomed by nitrobenzol, for instance, removal of the latter by shaking out with alcohol restores the fluorescence. The nitro group apparently does not have to be introduced into the molecule of the fluorescent substance itself in order to "cover up" the fluorescence. Other compounds employed as solvents, such as amyl alcohol, carbon bisulphide, aniline benzol, etc., appear to affect the fluorescence of petroleum oils in much the same way as Kauffman found for terephthalic acid esters. Distillation of crude petroleum at atmospheric pressure yields more highly fluorescent distillate than the same oil distilled in vacuo. The fluorescent substances therefore result from pyrogenic decomposition in much the same way as the fluorescent hydrocarbons obtained in the distillation of coal.

The Manufacture of Gasoline from Heavy Petroleum Oils (lantern): B. T. Brooks, R. F. Bacon and C. W. Clark.

Some Economic Phases of the Gasoline Supply: Benjamin T. Brooks.

Curves are given showing the rate of increase in the consumption of gasoline and its production from crude petroleum. Production of gasoline or motor spirit may be increased by (1) cracking heavier hydrocarbons, (2) employing motor spirit of lower Beaume gravity than now customary, (3) casing head gasoline. It is shown that benzol is not and probably can not be manufactured in sufficient quantity to meet the growing demand for motor fuel. Alcohol may be used to some extent should the price of gasoline exceed 40 cents per gallon. Alcohol is not now used for this purpose in England, where gasoline has been selling for approximately 40 cents for the last two years.

Absorption of Caustic Soda by Cellulose: W. D. Bancroft.

The Stability of Rosin at Slightly Elevated Temperatures.—A Correction: Chas. H. Herty and H. L. Cox.

The Chemists' Club: William L. Dudley.

The Chemist, a Growing Factor in Merchandizing: A. V. H. Mory.

The old rule of trade, "Let the buyer beware," is rapidly giving way to the rule, "Let the seller beware." The small consumer never has been able to more than roughly inspect the character of his purchases. The merchant has always been better able to afford a thorough inspection. Now that the law is placing the responsibility on him, the merchant is more and more under the necessity of turning to technical aid. There is also a natural law, making rigid inspection on the part of the merchant a good business investment, viz.: The satisfied customer is the basis for permanent merchandizing success, and satisfaction can come only through insuring quality and accuracy in description. A new field, therefore, which may be called laboratory inspection of merchandise, is rapidly growing, and is likely to receive great impetus through the enactment of general commodity laws.

The Method of Analysis of Gasoline: G. W. Gray.

The Method of Testing Illuminating Oils: G. W. Gray.

Coal Ash in Some Unusual Phases: S. W. Parr.

A Thermoelectric Method of Determining the Purity of Platinum Ware: G. K. Burgess and P. D. Sale.

As illustrated for crucibles, this method consists in measuring the E.M.F. across the crucible rim, one side being heated and the other not. A fine wire (0.2 mm.) of pure platinum is arc-soldered to one side and a Pt, Pt-Rh junction to the other. The iridium content or platinum purity of the crucible may be very exactly determined by the E.M.F. developed between the Pt wires and the temperature as measured by the Pt, Pt-Rh thermocouple, using an ordinary pyrometer galvanometer. The Bureau of Standards is prepared to test the platinum purity of crucibles by this method.

A Nevada Oil Shale: Chas. Baskerville.

The Metallography of Malleable Iron: J. Culver Hartzell.

A brief survey of the field with special reference to the difficulties encountered in correlating the chemical and structural analyses of malleable cast iron in the hard and in the annealed states.

The Pyrometer in the Assay Muffle: FREDERIC P. DEWEY.

Standing alone, by itself, a pyrometer reading has absolutely no value as a control of assay operations in a muffle or as a guide to the assayer in carrying on such operations. The reasons for this are varied and complex. In the first place, the temperature that controls the success of the operation is that of the lead button undergoing oxidation. At present we have no means of learning this temperature under practical working conditions, so that some suitable place must be selected within the muffle for the location of a pyrometer. Unfortunately, however, and in the second place, there is absolutely no approach even to a fixed relation between the pyrometer reading at any given point available and the temperature of the oxidizing button. The oxidation of the lead supplies much heat to the button, but its effect upon the pyrometer is negligible. One factor governing the amount of heat utilized by the button is the rate of oxidation of the lead, and this in turn is, within wide limits, largely influenced by the passage of the air over the button, so that to fully utilize and apply the pyrometer reading we must also know the height of the barometer and the effect of variations in the barometer readings upon the draft of the particular muffle under consideration. Further and most important, from a practical standpoint, is the freedom of entrance for the air to the muffle. In other words, by manipulating the door or stopper of the muffle, widely varying differences between the button temperature and the pyrometer reading may be produced. The effect of the door condition is twofold. It affects the supply of air to the button and also the actual temperature of the bottom of the muffle on account of varying amounts of air that have to be heated there in passing through the furnace. Finally, the relation of the position of the button within the muffle to that of the pyrometer is vital. Therefore, to intelligently utilize any stated pyrometer reading it is essential to have exact information upon a variety of other conditions surrounding the operation. However, the pyrometer is a good general guide to temperature conditions, but the man who depends upon it entirely will not be a good cupeller.

Note on a Cause of Spontaneous Combustion in Coal Mines: HORACE G. PORTER.

Graphical Studies of the Ultimate Analyses of Coals: OLIVER C. RALSTON.

Plotting the ultimate analyses of coals, in terms of carbon, hydrogen and oxygen, on the "ternary diagram" as modified to compensate the greater errors involved in the term "oxygen," has given results of surprising concordance. Some thousands of analyses are plotted with different objects in view. Classification into anthracite, semi-anthracite, semi-bituminous, bituminous, etc., is very easy, as each of these falls in a certain area of the diagram. The effects of oxidizing coals, heating them, fractionating them mechanically, chemically and physically, etc., are studied with the revelation of many interesting relations. Methods are given of judging with fair accuracy the calorific value, volatile and moisture of the coals in different parts of the diagram. All the analyses in Bull. 22 of the Bureau of Mines are plotted and constitute an interesting criticism on the accuracy of work done there and seem to fall within probable error, as near as such an error can be calculated on such a complex substance as coal. This paper will be published by the Bureau of Mines.

Osage Orange, Its Value as a Commercial Dyestuff: F. W. KRESSMANN.

It has long been known in the southwest that the wood of the Osage orange tree contains a dyestuff that would give a more or less fast yellow color.

An examination of the wood from Texas showed that it not only contains moric acid and morintannic acid, the same as fustic wood, but also that the dyeing principles are present in amount to be commercially valuable. A comparative series of dyeing experiments made with fustic and Osage orange wood and extracts showed the latter to be of equal value with fustic in regard to depth of colors produced, the amount of extract, the character of the dyeing and fastness to light, weather, washing, etc.

Some Preliminary Experiments on the Hydrolysis of White Spruce, etc.: F. W. KRESSMANN.

On hydrolyzing spruce with dilute sulphuric acid solutions it was found that the yields of sugar increased rapidly with increasing pressures of digestion up to a pressure of 7½ atmospheres, above which point the decrease was quite rapid. The reaction is probably reversible, since the large decrease can not be accounted for entirely by sugar decomposition.

About 70 per cent. of the total sugar produced

is fermentable. Yields of 23 gallons of 95 per cent. alcohol per dry ton of wood have been obtained. Acetic and formic acids are also products of hydrolysis, the yield of the former being constant (about 1.42 per cent.) over a wide range of cooking conditions. The yield of formic acid increases with increasing severity of cooking conditions. The acetic acid and part of the formic acid are probably due to hydrolysis of acetyl and formyl in the lignin complex, while part of the formic acid results from sugar decomposition.

A Method for the Rapid Quantitative Analysis of Bronze and Brass, Pb, Cu, Sn, Sb, Fe and Zn: Richard Edwin Lee, John P. Trickey and Walter H. Fegely.

The authors of this paper have made a careful experimental survey of the majority of the better-known methods for the quantitative analysis of brass and bronze, but have failed to find a method which was both rapid and accurate. It is pointed out that such a method is needed for "control" work, as well as for routine work in testing laboratories. The authors have then formulated a scheme for the quantitative analysis of these alloys which is apparently very rapid and at the same time meets the usual requirements in regard to accuracy. It is claimed that the complete analysis of three different bronzes containing Pb, Cu, Sn and Zn can be completed inside of two hours. Each determination is made on a separate portion of the sample. The series of test experiments incorporated in the paper indicates that the methods permit of a wide application. The maximum error of any determination in any series is .15 per cent.; the average error, however, is much less.

A Method for the Rapid Quantitative Analysis of Babbitt Metals, Pb, Cu, Sn and Sb: Richard Edwin Lee, John P. Trickey and Walter H. Fegely.

This paper contains a report of a rapid and accurate method for the quantitative analysis of Babbitt metals. The chief objection urged by the authors against the majority of the methods that have been proposed is that they require too much time for their execution. In the method reported, each determination is made from a separate portion of the sample, with the exception of Sn, which is determined volumetrically in the same solution in which Sb is determined. The maximum error is .15 per cent.; the average error, however, is less. Demorest's method has been articulated with the proposed method so that an alloy close to the limit of the specification may be checked by a different although longer method. The methods have been tested in two large commercial laboratories for several months and found satisfactory.

The Composition and Testing of Printing Inks: J. B. Tuttle and W. H. Smith.

The Determination of Carbon in Iron and Steel by the Barium-Carbonate Titration Method: J. R. Cain.

The apparatus used for filtration, difficulties and sources of error, with means of obviating these, are described, and details are given of a series of experiments showing the special application and the degree of accuracy of the barium carbonate titration method when applied in steel analysis.

Determination of Ammonia in Illuminating Gas: J. D. Edwards.

This paper is a summary of the results of a brief investigation of the apparatus and methods employed for the commercial determination of ammonia in illuminating gas. The five forms of apparatus studied gave results, when properly operated, well within the limits of accuracy required for this determination either for commercial control work or for the purpose of gas inspection. Suitable indicators have been recommended and precautions to be observed in the operation of the different forms of apparatus have been pointed out.

The Iodine Number of Linseed and Petroleum Oils: W. H. Smith and J. B. Tuttle.

The iodine values of raw, boiled and burnt linseed oils, and petroleum oils, were determined by the Hanus method, varying widely the amounts of oil and iodine used, and the time of absorption. A study of the effect of temperature on the iodine value was made. It is shown that in order to obtain concordant results, a prescribed procedure must be followed, and exact conditions stated.

Chemical Jurisprudence: Louis Hogrefe.

Report of the Committee on Alum Specifications.

SECTION OF INDIA RUBBER CHEMISTRY

D. A. Cutler, Chairman

Dorris Whipple, Secretary

The Influence of Temperature in the Physical Testing of Rubber Goods: T. L. Wormeley and J. B. Tuttle.

Review of Report of Joint Rubber Insulating Committee: Dorris Whipple.

Charles L. Parsons,
Secretary

(*To be continued*)